'S LANDS PLANTENTUIN
(INSTITUTS SCIENTIFIQUES DE BUITENZORG)

TREUBIA

BIJDRAGEN OVER ZOOLOGIE, HYDROBIOLOGIE EN OCEANOGRAPHIE VAN DEN OOST-INDISCHEN ARCHIPEL

ONDER REDACTIE VAN

Dr. K. W. DAMMERMAN
Hoofd van het Zoölogisch Museum en Laboratorium
te Buitenzorg (Java).

DEEL 16
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HYDROLOGICAL AND ICHTHYOLOGICAL OBSERVATIONS IN THE MOUTH OF THE KUMAI-RIVER (S.W. BORNEO).

By

Dr. J. D. F. HARDENBERG

(Laboratorium van het Onderzoek der Zee, Batavia)

INTRODUCTION. The Kumai-river is situated in the south-western part of Borneo and flows out into the Java-Sea. It is one of the smaller rivers and its waters contain only a relatively small amount of mud. The Kumai is very well navigable for small-sized sea-going ships. The average depth is from about thirty to more than fifty feet, apart from a bar just before the mouth, while the average breadth is about 750 m. At about 50 nautical miles from the mouth the river ceases to be navigable. At this point two smaller rivers flow together to form the Kumai proper. The banks of the river are by far the greater part covered with primaeval forest forming a dense jungle with high trees. Only quite near the mouth mangrove- and nipah swamps are found. A small native village, Kumai, lies on the right bank. Just above the mouth the river shows a lake-like widening, which is shut of from the sea by a narrow "Nehrung".

HYDROLOGY. The Kumai-river seems to be dependent for the greater part of direct rainfall. At the end of the West-Monsoon (April-May), which is the rain-monsoon here, the water of the river is almost fresh and even at a great distance out in sea we find a very low salinity. At the end of the dry East-Monsoon (September-October) the salinity is much higher and even at the highest navigable point of the river we find salinities of about $20\,^0/_{00}$ at the surface. In these months the Kumai seems more an arm of the sea than a river.

These differences in salinity are expressed in fig. 1. On the vertical axis the salinities are expressed and on the horizontal one the distance in nautical miles before and above the mouth of the Kumai. Only the salinities at the surface are given here. Four series of observations are dealt with. Two (Sept. 1928 en 1930) at the end of the East-Monsoon are given in a full line and two at the end of West-Monsoon in a dotted line (May 1930 on 1931). Two more observations in April and October 1932 were made but as these showed nothing new I have omitted them in the figure, to avoid an overcrowding with lines.

We see at a single glance the difference in salinity at the end of the dry and at the end of the wet monsoon, a difference which is not only very clearly expressed in the waters of the river itself, but also far out at sea. For a full understanding I must state here also that in the Java-sea (at least in its western

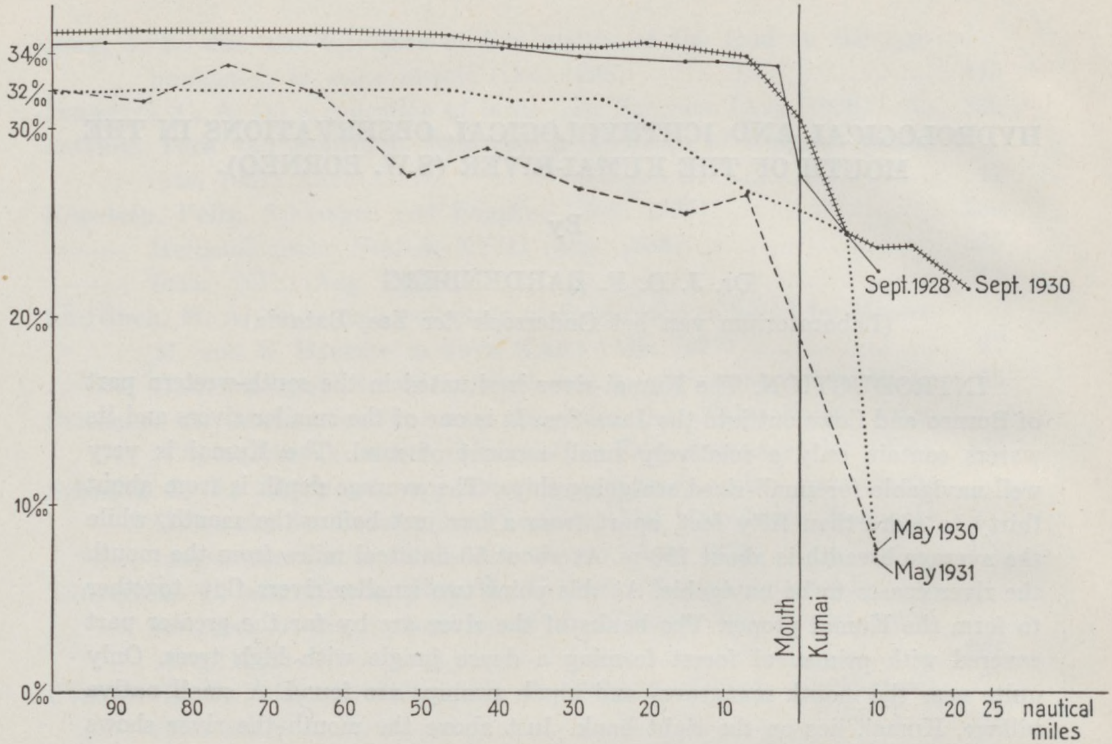

Fig. 1. Curve of the salinities at the surface in and before the Kumai-river. On the horizontal axis the distance in nautical miles is expressed and at the vertical axis the salinity in ‰.

half) the salinity is about 2 ‰ lower during the West-Monsoon than during the East-Monsoon. However if we cross the Java-sea from Java to Borneo we shall find that about midway the salinity shows already a decrease in the West Monsoon. This decrease which is caused by the great outflow of fresh-water from the great Borneoan rivers is small at first and becomes steeper later on. Only the latter part is expressed in the figure. The reader will see that in three of the four series of observations, the observations cease at about 10 miles above the mouth of the river. Originally the observations were only made in accordance with DELSMAN's researches on pelagic eggs of marine- and coastal-fishes and as the eggs were not found higher up than about 10 miles above the rivermouths the observations ceased there.

Each line in the figure represents of course only the state of things on a single day but we may safely assume that on other days no great and essential differences will be found. Low- and hightide have not much influence either, as the difference between them is only one meter or less.

In the course of my first four visits to the Kumai it struck me that the fishermen on the river near the little village of Kumai (about 10 nautical miles above the mouth) caught so many fishes as for instance *Cybium*- and *Trichiurus*-

species, which one would not expect at such a low salinity. Therefore during my fifth and sixth visit I took samples of water, not only from the surface, but also from the lower waterlayers.

The results of these series of observations are given below, first the observations in April 1932 and secondly those in October 1932.

S_0 means that the sample was taken from the surface, S_1 one meter below the surface and so on. The salinities were computed with the aid of an areometer. It showed, that although the superficial waterlayers were brackish, the lower layers near the bottom had a much higher salinity. Thus the presence of the above named seafishes could be very well explained by this high salinity in the lower waterlayers and it is not necessary to assume that these species are especially adapted to a life in the brackish water of tidal rivers. Of course the same explanation holds good for all marine fishes, which are caught now and then in the lower part of rivers. I think that in literature, these facts are not always sufficiently taken into account.

Series of observations in April 1932.

I In sea, 24 nautical miles in front of the rivermouth [1]).

S_0 — 26.88 $^0/_{00}$		S_6 — 30.75 $^0/_{00}$ ← springlayer
S_1 — 26.86 $^0/_{00}$		S_7 — 31.46 $^0/_{00}$
S_2 — 27.30 $^0/_{00}$		S_8 — 31.82 $^0/_{00}$
S_3 — 27.55 $^0/_{00}$		S_{10} — 31.94 $^0/_{00}$
S_4 — 28.03 $^0/_{00}$		S_{12} — 31.74 $^0/_{00}$
S_5 — 28.30 $^0/_{00}$		

II 20 miles in front of the rivermouth.

S_0 — 27.72 $^0/_{00}$ [2])		S_7 — 31.27 $^0/_{00}$
S_1 — 27.63 $^0/_{00}$		S_8 — 31.65 $^0/_{00}$
S_2 — 27.63 $^0/_{00}$		S_9 — 31.91 $^0/_{00}$
S_3 — 27.55 $^0/_{00}$		S_{10} — 31.70 $^0/_{00}$
S_4 — 28.55 $^0/_{00}$	← springlayer	S_{11} — 31.78 $^0/_{00}$
S_5 — 30.39 $^0/_{00}$		S_{12} — 31.78 $^0/_{00}$
S_6 — 30.75 $^0/_{00}$		S_{13} — 31.91 $^0/_{00}$

III 14.5 miles in front of the rivermouth.

S_0 — 27.52 $^0/_{00}$		S_7 — 30.01 $^0/_{00}$
S_3 — 27.52 $^0/_{00}$		S_8 — 30.39 $^0/_{00}$
S_4 — 29.58 $^0/_{00}$	← springlayer	S_9 — 31.17 $^0/_{00}$
S_5 — 29.75 $^0/_{00}$		S_{10} — 31.69 $^0/_{00}$
S_6 — 29.88 $^0/_{00}$		S_{11} — 31.47 $^0/_{00}$

IV 10 miles in front of the rivermouth.

S_0 — 26.54 $^0/_{00}$		S_6 — 30.84 $^0/_{00}$

[1]) If in two or more layers of 1 meter the salinity was the same I have omitted in the table the figures for the lowermost ones.

[2]) (Somewhat higher as at the first station!)

S_1 — 27.03 $^0/_{00}$	S_7 — 30.97 $^0/_{00}$
S_3 — 27.02 $^0/_{00}$	S_8 — 31.09 $^0/_{00}$
S_4 — 27.48 $^0/_{00}$ ← springlayer	S_9 — 31.23 $^0/_{00}$
S_5 — 30.62 $^0/_{00}$	

V 6 miles in front of the rivermouth.

S_0 — 24.63 $^0/_{00}$	S_6 — 30.34 $^0/_{00}$

Because of the navigation in the narrow channel between the banks there was no time to make more observations.

VI In the mouth of the river.

S_0 — 18.72 $^0/_{00}$	S_3 — 26.36 $^0/_{00}$ ← springlayer
S_1 — 20.56 $^0/_{00}$	S_4 — 26.89 $^0/_{00}$
S_2 — 22.77 $^0/_{00}$	S_5 — 27.02 $^0/_{00}$

VII 6 miles above the rivermouth.

S_0 — 11.47 $^0/_{00}$	S_5 — 18.59 $^0/_{00}$
S_1 — 14.18 $^0/_{00}$	S_6 — 19.38 $^0/_{00}$
S_2 — 13.42 $^0/_{00}$	S_8 — 20.23 $^0/_{00}$
S_3 — 13.55 $^0/_{00}$ ← springlayer	S_{10} — 20.75 $^0/_{00}$
S_4 — 16.29 $^0/_{00}$	S_{12} — 21.80 $^0/_{00}$

VIII 10 miles above the rivermouth.

S_0 — 10.84 $^0/_{00}$ ← springlayer	S_5 — 14.71 $^0/_{00}$
S_1 — 12.05 $^0/_{00}$	S_6 — 15.26 $^0/_{00}$
S_2 — 12.90 $^0/_{00}$	S_8 — 15.79 $^0/_{00}$
S_3 — 13.96 $^0/_{00}$	S_{10} — 17.08 $^0/_{00}$
S_4 — 14.18 $^0/_{00}$	S_{12} — 17.47 $^0/_{00}$

Series of observations in October 1932 at the end of the dry monsoon.

IX 20 miles in front of the mouth.

S_0 — 30.70 $^0/_{00}$	S_6 — 32.70 $^0/_{00}$ ← springlayer
S_1 — 31.29 $^0/_{00}$	S_7 — 33.09 $^0/_{00}$
S_2 — 31.78 $^0/_{00}$	S_8 — 33.35 $^0/_{00}$
S_3 — 31.80 $^0/_{00}$	S_9 — 33.42 $^0/_{00}$
S_4 — 31.84 $^0/_{00}$ ← springlayer	S_{10} — 33.52 $^0/_{00}$
S_5 — 32.70 $^0/_{00}$	S_{11} — 33.64 $^0/_{00}$

X 14½ miles in front of the rivermouth.

S_0 — 31.52 $^0/_{00}$	S_4 — 31.93 $^0/_{00}$ ← springlayer
S_1 — 31.63 $^0/_{00}$	S_5 — 32.70 $^0/_{00}$
S_2 — 31.63 $^0/_{00}$	S_6 — 33.35 $^0/_{00}$
S_3 — 31.63 $^0/_{00}$	S_{7-10} ± 33.48 $^0/_{00}$

XI 10 miles in front of the rivermouth.

S_0 — 31.47 $^0/_{00}$	S_4 — 32.72 $^0/_{00}$
S_1 — 31.55 $^0/_{00}$	S_5 — 32.83 $^0/_{00}$
S_2 — 31.46 $^0/_{00}$ ← springlayer	S_6 — 32.88 $^0/_{00}$
S_3 — 32.37 $^0/_{00}$	

XII 6 miles in front of the rivermouth.

S_0 — 32.07 ‰ S_3 — 32.03 ‰

S_1 — 31.85 ‰

XIII In the mouth of the river.

S_0 — 25.55 ‰ S_6 — 26.16 ‰

S_1 — 25.66 ‰ S_7 — 26.58 ‰

S_2 — 25.82 ‰

XIV 6 miles above the rivermouth.

S_0 — 15.64 ‰ S_3 — 21.37 ‰

S_1 — 15.74 ‰ S_4 — 23.19 ‰

S_2 — 20.55 ‰ ← springlayer

XV 10 miles above the rivermouth.

S_0 — 13.78 ‰ S_5 — 21.60 ‰

S_1 — 15.34 ‰ S_6 — 22.38 ‰

S_2 — 15.14 ‰ S_8 — 23.21 ‰

S_3 — 14.89 ‰ S_{11} — 23.83 ‰

S_4 — 20.52 ‰ ← springlayer

XVI 15 miles above the rivermouth.

S_0 — 9.92 ‰ S_5 — 21.37 ‰

S_1 — 10.70 ‰ S_6 — 23.12 ‰

S_2 — 12.16 ‰ S_7 — 23.40 ‰

S_3 — 17.90 ‰ ← springlayer S_{11} — 23.91 ‰

S_4 — 19.42 ‰

XVII 20 miles above the rivermouth.

S_0 — 10.94 ‰ S_4 — 18.06 ‰

S_1 — 10.71 ‰ S_5 — 20.80 ‰

S_2 — 13.50 ‰ S_6 — 22.10 ‰

S_3 — 15.01 ‰

XVIII 25 miles above the rivermouth.

The water at the surface is quite fresh now. I was not able to get samples of deeper layers as I had to go to this place in the ship's small boat, which had no means on board to use waterbottle. The ship itself could not go to this place as the river is only 6 - 9 feet deep there in the deepest parts. I think we can safely assume that if the bottomwater was somewhat brackish the salinity at any rate was below 15 ‰ (See XVII S_3) and more probably much lower.

Looking at the figures given above we can remark the following.

1. The differences between the salinities of the uppermost and lowermost waterlayers are not constant. As could be expected these differences are greater at the end of the wet than at the end of the dry monsoon, as during the wet monsoon the outflow of fresh water is much greater. It is curious to see that the differences become smaller when we approach the mouth of the river and

become greater in, and some distance above the mouth, whereas they become smaller again further inland. For convenience sake, I have give below a table showing the differences in salinity between the lowermost and the uppermost layer [1]).

Wet monsoon.	*I* °/₀₀	*II* °/₀₀	*III* °/₀₀	*IV* °/₀₀	*V* °/₀₀	*VI* (mouth) °/₀₀	*VII* °/₀₀	*VIII* °/₀₀		
Lowermost waterlayer.	31.74	31.91	31.47	31.23	30.34	27.02	21.80	17.47		
Uppermost waterlayer.	26.88	27.72	27.52	28.54	24.63	18.72	11.47	10.84		
Difference.	4.86	4.90	3.95	4.69	5.71	8.30	10.33	6.63		
Dry monsoon.		*IX* °/₀₀	*X* °/₀₀	*XI* °/₀₀	*XII* °/₀₀	*XIII* (mouth) °/₀₀	*XIV* °/₀₀	*XVI* °/₀₀	*XVII* °/₀₀	*XVIII* °/₀₀
Lowermost waterlayer.		33.64	33.48	32.88	32.03	26.68	23.19	23.83	23.91	22.10
Uppermost waterlayer.		30.70	31.52	31.71	31.07	25.55	15.64	13.78	9.92	10.94
Difference.		2.94	1.96	1.17	0.96	1.13	7.55	10.05	13.99	11.16

2. The salinity does not always increase with greater depth. In several instances (I, VI, VII, XI, XVII) we see that the salinity decreases at greater depth. These irregularities are due of course to a turbulence in the water caused by the stream. Differences in temperature in the upper and lower waterlayers, which may cause convectionstreams, can be neglected or almost neglected as these differences were at the utmost a few tenths of degree only.

3. In most cases we find a springlayer. Of this springlayer we may remark.

a. The springlayer seems to be absent in a few instances as can be seen in the tables given above.

b. The depth at which the springlayer is found is not always the same. Its depth seems to be increasing when farther in sea.

c. In one case (IX) there seem to be two spriglayers.

d. The springlayer is not dependent on a given salinity. At each station the salinities of the springlayer are different. There does not seem to exist any rule.

4. Surfacesalinities do not tell us anything about the salinities of the deeper waterlayers, which as a rule are much higher. From a biological standpoint this is of importance. Many species of fish are described as entering brackish or even fresh water. From the above numbers it follows that the animals can enter tidal rivermouths without coming into a salinity which is too low for them. The adaptability of these species to salinities much lower

[1]) The place (station) where the salinities given in II were found is the same as the place where the salinities given in IX were taken. The same can be said of III and X, IV and XI, and so on.

than seawater is only apparent therefore. When swimming in the lower waterlayers these fishes can remain in the salinity of the high or rather high concentration which fits them. A superficial observer, when looking at the catch of a fisherman from the river in the vicinity of its mouth and seeing species of sea-fish, might think therefore, that these species are able to live in fresh water or in water with a rather low salt-concentration, judging from the salinity at the surface only. In reality this is not the case, as these seafishes have been caught in the deeper waterlayers of a much higher salinity. Thus far in literature there is laid no sufficient stress on this fact.

It should be remarked here that I have observed the same facts in other rivers, where the figures were sometimes even more striking. But as I do not possess such a complete series of observations of these other rivers I have preferred to give the figures of the Kumai instead. Of course each river will have its own peculiarities and the distribution of the salinities may be altered by many circumstances, as for instance a decrease or increase of the outflowing of freshwater, presence or absence of a bar before the mouth, higher or lower saltconcentration of the seawater before the mouth and so on.

On searching the literature it was very surprising to find how little there was known and published about the mixing of fresh- and saltwater in estuaries. Most authors seemed to take it for granted that the mixing of the sea- and the riverwater takes place quite regularly and gradually, the riverwater spreading more or less fanlike over the heavier seawater. As a matter of fact this is indeed the case in some European rivers, as for instance the river Elbe in Germany and in the estuary of the Schelde in the Netherlands. Here we find the salinity gradually increasing from surface to bottom. I will refrain from giving many figures here; a single example will be sufficient in the scope of this paper.

So E. Kolumbe in the "Archiv für Hydrobiologie, Bnd. XXII, 1932, published some data about the salinity of the Elbe. He found, for instance, near Brünsbüttel at the end of high tide, a salinity of 8.7 ‰ at the surface, of 9.6 ‰ at a depth from 5 - 9 m and of 10.3 ‰ at a depth from 9 - 14 m. It is easy to see that salinity increases with depth. A springlayer does not exist, or if it does the differences are very small and not so great as in the Kumairiver.

It is obvious that the existence of the springlayer in the Kumai and the non-existence of it in the Elbe must have a cause. It is also obvious that temperature-differences cannot form this cause as in the first place temperature-differences in the tropics in such relatively shallow water as in the Kumai-mouth can be neglected — as had been pointed out above — and in the second place eventually existing temperature-differences, which are probably much greater in the Elbe, would tend to increase sudden differences in salinity as the lower water will be colder and heavier, whereby a gradual and regular mixing will be retarded. This is not the case, so that the origin of the spring-layers must be found somewhere else.

When comparing charts of the Kumai and the Elbe-mouth one is struck by the fact that the Kumai-river has its deeper waterlayers completely shut

off from the sea by a bar in the mouth, whereas the Elbe has only sand — or mudbanks there, leaving an open communication between the deeper parts of the river and the corresponding regions of the open sea. Now it is easy to understand, that in the Kumai the upper waterlayers will have a circulation quite different from the deeper ones lying at a depth below the surface of the bar in the mouth. When at high tide the seawater, with its higher salinity, is flowing into the river, it will cross the bar and by its greater density flow down to the riverbottom several metres below the surface of the bar, causing a kind of subaquatic waterfall of heavy water below the more superficial layers with a lower degree of salinity. The water with a high degree of salinity, down below, is now trapped and will remain more or less stationary on large parts of the riverbottom, where even at low tide, it will mix only very slowly with the water of a lower salinity, which flows over it. A similar effect has been described by H. B. HACHEY in his very interesting article "Tidal mixing in an estuary" (Journal Biol. Board of Canada I 1935). There, in the mouth of the St. John river in Canada, matters are more complicated by the different temperatures in the different layers, but there too, the springlayer exists behind a bar. The existence of a springlayer therefore seems to be only dependent on the presence of a bar in the rivermouth.

LIST OF FISHES OCCURRING IN THE KUMAI.

Fam. Elopsidae.

1. *Elops hawaiensis* T. REGAN.

Fam. Dussumieriidae.

3. *Dussumieria* spec. In a future publication I shall deal with the question whether there are one or more species of *Dussumieria* in the Archipelago.

Fam. Chirocentridae.

2. *Chirocentrus hypselosoma* BLKR.

Fam. Dorosomidae.

4. *Dorosoma chacunda* (HAM. BUCH.).

Fam. Stolephoridae.

5. *Setipinna melanochir* (BLKR.).
6. *Setipinna breviceps* (CANTOR.).
7. *Setipinna taty* (C.V.).
8. *Stolephorus insularis* HARDENBERG.
9. *Stolephorus indicus* (v. HASS.).
10. *Stolephorus commersonii* LAC.
11. *Stolephorus tri* (BLKR.).
12. *Stolephorus baganensis* HARDENBERG.
13. *Coilia macrognathus* BLKR. See also Treubia Vol. XIV 1934.

Fam. Clupeidae.

14. *Clupea toli* C.V.
15. *Clupea fimbriata* (C.V.).
16. *Pellona hoevenii* Blkr.
17. *Pellona kampeni* Weber and de Beaufort. See also Treubia Vol. XIV 1934.
19. *Pellona amblyuropterus* Blkr.
20. *Pellona elongata* (Benn.).
21. *Pellona dussumieri* C.V.
22. *Opisthopterus macrognathus* Blkr.

Fam. Harpadontidae.

23. *Harpadon nehereus* (Ham. Buch.).

Fam. Claridae.

24. *Clarias leiacanthus* Blkr.

Fam. Siluridae.

25. *Callichrous weberi* Hardenberg.

D.4; P.1.8; V.6; A.41.

Height 4.8, head 5.4 in length without caudal. Eye covered by skin, 4 in head. Lower border of eye touching horizontal through corner of mouth. Eye 1.5 in snout. Jaws subequal. Upper profile slightly rounded with a slight concavity at the nape. Highest point of back somewhat behind dorsal. Maxillary barbels reaching to tenth ray of anal. Mandibulary barbels situated before eyes, about twice as long. Height of dorsal about 3-eyediameters. Dorsal situated just before origin of anal, its distance from the snout about 2½ in its distance from the caudal. Anal connected with the caudal which is deeply forked with rounded lobes. Ventrals about as long as snout. Pectorals rounded, about as long as head without snout. Vomerine patches of teeth small. Colour of formolspecimen brownish. A blackish spot behind gillopening. A black band along base of anal and along base of caudal.

One specimen with a total length of 50 mm. Kumai, May 1931.

In my paper "On a collection of fishes from the aestuary, the lower and middle course of the river Kapuas" I have described a *Callichrous* specimen which I have named *Callichrous weberi*. It is very probable that the specimen described above belongs to this species, though there are some differences. The most important of these are the length of the anal fin (41 rays in the Kumai-specimen and 47 in the specimen from the Kapuas). All other differences as for instance the height of the dorsal, the length of the mandibulary barbels and the colouration may be due to individual variation or to age. (The Kapuas-specimen is much greater!). At any rate as long as there is not more material available it is not justified to create a new species on the specimen described above.

Fam. Pangasidae.

26. *Pangasius pangasius* (HAM. BUCH.).

Fam. Ariidae.

27. *Arius maculatus* (THUNB.).
28. *Arius microcephalus* (BLKR.).
29. *Arius sagor* (HAM. BUCH.).
30. *Arius caelatus* C.V.
31. *Ketengus typus* BLKR.

Fam. Cyprinidae.

32. **Rasbora beauforti** nov. spec.

D.1.8; A.2.5; P.1.12; V.1.7; L.r. 28 - 29; L.l. incomplete consisting of 10 scales only; L.v. (before ventrals) 4½-1-2½.

Oblong. Height about 4 in length, 5 in length with caudal. Head about once in height. Eye 3 in head, about equal to snout. Cleft of mouth rather strongly descending, not reaching vertical through frontborder of eye. Origin of dorsal behind the middle between end of snout and origin of caudal, opposite to end of incomplete lateral line, 12 scales from occiput. Dorsal nearer to ventrals than to anal, its height somewhat shorter than head. Pectorals as long as head without snout, ventrals somewhat shorter. Longest ray of anal as long as postorbital part of head and half eye. Longest ray of caudal about as long as head. Caudal peduncle surrounded by 12 scales. Colouration of formolspecies dark, brownish above, much lighter below. A conspicious dark band along the sides, beginning on tip of snout and ending on caudal, running through the eye. This band is narrowest on the head and on the caudal fin. The black band is separated from the brownish back by a light streak. The first 12 - 13 scales in this streak have a blackish hindborder. Fins more or less pigmented, especially the dorsal and the caudal. Some specimens have the tip of the ventrals and of the anal blackish.

Many specimens from the Kumai-river, south-west Borneo. May 1931. Longest specimen 44 mm. Named in honour of Prof. Dr. L. F. DE BEAUFORT from Amsterdam.

33. *Puntius hexazona* WEBER and DE BEAUFORT.

Fam. Belonidae.

34. *Tylosurus strongylurus* (V. HASS.).

Fam. Hemirhampidae.

35. *Dermogenys orientalis* (M. WEBER.).

Fam. Polynemidae.

36. *Eleutheronema tetradactylum* (SHAW).
37. *Eleutheronema tridactylum* (BLKR.). (See also Treubia Vol. XIV '33).
38. *Polynemus indicus* SHAW.

Fam. Mugilidae.

39. *Mugil dussumieri* C.V.
40. *Mugil oligolepis* BLKR.

Fam. Anabantidae.

41. *Anabas testudineus* (BL.).
42. *Trichopodus trichopterus* (PALL.).
43. *Betta anabatoides* BLKR.

My largest specimen measured 64 mm. It is astonishing to see how much these small and young animals resemble specimens of *Betta picta* (C.V.) in colouration. Only the largest specimen showed traces of dark crossbars, all other had three black longitudinal bands from the head to the caudal just in the same manner as in *Betta picta.* WEBER and DE BEAUFORT, in their Fishes of the Indo-Australian Archipelago Vol. IV 1922 page 358, say "small specimens may also have a broad dark longitudinal band from snout to caudal in the middle of the side". It is evident that they did not posses the youngest stages. In all respects (measurements of head and body, number of scales, finrays and so on) my specimens answer so well to the description of *Betta anabatoides,* that there is no mistake possible, though at first sight one would take them for specimens of *B. picta.* Besides I possess fullgrown specimens of *B. picta,* as well as of *B. anabatoides* from other localities. Comparison showed that my above mentioned young specimens undoubtedly belong to the latter species.

Fam. Bothidae.

44. *Pseudorhombus arsius* (HAM. BUCH.).

Fam. Soleidae.

45. *Dexillus macrolepis* (BLKR.). For a description see Treubia Vol. XIV 1934.

Fam. Centropomidae.

46. *Lates calcarifer* (BL.).
47. *Ambassis kopsi* BLKR.
48. *Ambassis nalua* (H.B.).
49. *Ambassis gymnocephalus* (LAC.).
50. *Ambassis interrupta* BLKR.

Fam. Serranidae.

51. *Epinephelus megachir* (RICH.).

Fam. Theraponidae.

52. *Therapon* spec. I did not acquire a single specimen of Therapon. There is a *Therapon*-species which must be rather common, however, as everywhere on the river the sounds made by these fishes can be heard (See also HARDENBERG

"Ein Töne erzeugender Fish", Zoölogischer Anzeiger Bnd. 108, 1934, p. 224 - 227). Most probably this must be *Therapon theraps* C.V., as this is the species typical for rivermouths.

Fam. Trichiuridae.

53. *Trichiurus roelandti* BLKR.

Fam. Carangidae.

54. *Caranx sexfasciatus* Q.G.

Fam. Leiognathidae.

55. *Chorinemus tala* (C.V.) DAY.
56. *Leiognathus insidiator* (BL.).
57. *Leiognathus daura* (CUV.).
58. *Gerres oyena* (FORSK.).

Fam. Stromateidae.

59. *Stromateus cinereus* BLOCH.

Fam. Pristipomatidae.

60. *Pomadasys hasta* (BLOCH).
61. *Pomadasys maculatus* (BL.).

Fam. Lutjanidae.

62. *Lutjanus johnii* (BLOCH).

Fam. Scatophagidae.

63. *Scatophagus argus* (L.).

Fam. Girellidae.

64. *Proteracanthus sarissophorus* CANTOR.

Fam. Sciaenidae.

65. *Johnius belangeri* (C.V.).
66. *Otolithoides microdon* (BLKR.).
67. *Otolithes argenteus* (C.V.).
68. *Pama perarmata* (CHABANAUD).

Fam. Scombridae.

69. *Scomberomorus kühlii* (C.V.).
70. *Scomberomorus guttatus* (BL. SCHN.).

Fam. Cottidae.

71. *Platycephalus insidiator* (FORSK.).

Fam. Toxotidae.

72. *Toxotes chatareus* (HAM. BUCH.).

Fam. Gobiidae.

73. *Stigmatogobius javanicus* BLKR.
74. *Colius macrocephalus* (BLKR.).
75. *Trypauchenichthys typus* BLKR.

Fam. Gymnodontes.

76. *Tetrodon fluviatilis* HAM. BUCH.
77. *Tetrodon lunaris* BL. SCHN.

Fam. Carcharidae.

78. *Carcharinus dussumieri* (MÜLLER and HENLE). *Physodon mülleri* (MÜLLER and HENLE), which is so common in other rivermouths, seems to be lacking here.

Fam. Cestraciontidae.

79. *Cestracion blochii* (CUV.).

Fam. Dasybatidae.

80. *Dasybatus imbricatis* (SCHNEIDER.).

Of course the list given above is not complete. The fishing is not so exhaustive as in other rivermouths, as for instance in the Rokan- and the Musimouth. Only gillnets are used, apart from a few cast-nets and square-nets along the banks of the river. Were other implements used, then of course, the occurrence of many other species might have been stated. During the wet monsoon there is hardly any fishing. The true freshwaterspecies which I got are very few therefore.

As far as I can judge from the data obtained the fishfauna of the Kumai shows the following peculiarities when compared with the fauna of other rivermouths [1]).

1. The occurrence of so much *Stolephorus* species. Only in the mouth of the Musi I found also several species of *Stolephorus*. In literature the occurrence in tidal-rivers is mentioned for *St. indicus* and *tri*. In my experience however I found this to be the case only for *St. indicus*. *St. tri* is a species which lives in front of rivermouths and which spawns in water with a salinity of $\pm$ 25 ‰ or more. I have never found it in tidal rivers, the Kumai excepted. Perhaps several authors have mistaken my species *baganensis* (which does live regularly in tidal rivers!) for *tri*, which is much

[1]) The differences are especially noteworthy when compared with the fauna of the Sumatra rivermouths. The differences with the only other Bornean river (the Kapuas) of which I have a rather complete list of the fishfauna is much smaller!

alike, as I have pointed out elsewhere (See HARDENBERG, Treubia Vol. XIV 1934). Within shortly I shall deal with this question in detail in a separate paper.

2. The occurrence of *Clupea fimbriata*. *Cl. fimbriata* is a species which lives in the open sea sometimes quite near the shore but always in clear water of high salinity. It may occur in front of the mouth of big rivers (as for instance the Rokan, see Treubia Vol. XIV 1934) but on no other occasion did I find it in a tidal river.
3. The occurrence of *Carcharinus dussumieri* and the apparent absence of *Physodon mülleri*. I have found *C. Dussumieri* in no other river or rivermouth while *Ph. mülleri* is a common rivermouth species. It may be of course that after all *Ph. mülleri* does occur in the Kumai too and that I only did not meet it during my short visits. At any rate it cannot be as common as *C. dussumieri* of which I saw about 20 specimens and which is absent from other rivermouths known to me.
4. The occurrence of several species of the genus *Ambassis*. Several *Ambassis*-species can be found according to literature in sea- and in freshwater. Yet in my collections of rivermouthfishes I have only *Ambassis*-specimens from the mouth of the Kapuas-river in W. Borneo. In all my Sumatra-collections there is not a single specimen. We must assume therefore that not in all rivermouths the conditions are favourable to *Ambassis*. It seems that there are different types of estuaries, as I found peculiarities in the distribution of other families too. Perhaps the quantity of mud in the estuary is an important factor. Shortly I hope to deal with these questions in detail in a separate paper.
5. Another peculiarity is the presence of *Sciaena* species, which are others than those found in other rivermouths known to me. For these facts too I will refer to the future paper mentioned above.
6. Species of *Otholithoides* (*Sciaenoides*) seem to be absent or at any rate very rare. Especially the absence of *O. biauritus* is a striking fact. If this species were common as in other rivermouths I should in any case have seen a few specimens.
7. I got one specimen of *Caranx sexfasciatus*. WEBER and DE BEAUFORT say that this species lives in sea and in brackish water and that it enters tidal rivers. Again, I found this only to be the case in the Kumai and the Kapuas as was case with the species of *Ambassis*.
8. The occurrence of ripe specimens of *Scomberomorus* species! Whenever I got specimens of *Scomberomorus* in rivermouths it was only young individuals, mostly belonging to *Scomberomorus kühli*. Ripe specimens I only saw far out in sea, in water of a high salinity. DELSMAN found even the plantonic eggs of Scomberomorus in the Kumai as far as 10 miles upstreams from the mouth.

SOME *ACRIDIDAE* FROM THE SOLOMON ISLANDS *(ORTHOPTERA).*

By

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British Museum (Natural History).

The following notes and descriptions are based on the collections made during the last few years by Messrs. H. T. PAGDEN and R. A. LEVER. The specimens, apart from some duplicates, have been presented to the British Museum (Natural History).

The list of Acrididae known from the Solomon Islands is as yet very short, but the fact that there exist in the islands several endemic genera, each with a number of species and subspecies, suggests that further careful collecting on each of the islands should result in a considerable number of new discoveries. Fortunately, Mr. LEVER is still continuing his work in the islands, and we may look forward to a complete list of their fauna.

Subfamily Oedipodinae.

Heteropternis obscurella (BLANCHARD, 1853).

Guadalcanal Island, Lunga, coconut, 20.XII.1933; do., *Imperata*, 20 - 21. XII.1933; Boregi river, 14.XII.1934. — Kolombangara, Karikanga, at night, 6.VI.1934. — San Cristobal Island, Arosi, V.1935.

Gastrimargus marmoratus (THUNBERG, 1815).

Tulagi Island, ridge, 13.VIII.1933; lalang on ridge, 29.I.1935; sasapi cutting, 16.XII.1934; Guadalcanal Island, I.1932.

Locusta migratoria (L.) sbsp.

Guadalcanal Island, Lunga, *Imperata,* 18.XII.1933; 21.XII.1933. The subspecies of the Migratory Locust occurring on various islands of Oceania and in Australia is awaiting its systematic study.

Subfamily Pyrgomorphinae.

Atractomorpha sp.

Several specimens from three various islands cannot be determined specifically without a thorough revision of this difficult genus.

Subfamily Catantopinae.

Gesonia sanguinolenta KRAUSS 1902.

1898. *Gesonia sanguinolenta*, BRUNNER VON WATTENWYL, Abh. Senckenberg. naturwiss. Ges., XXIV, p. 198 (*nomen nudum*!).
1902. *Gesonia sanguinolenta*, KRAUSS in SEMON: Zool. Forschungsreise in Australien und Mal. Archipel, p. 760.

Guadalcanal Isl., Lavoro, on *taro*, 18.II.1934. — Malaita Isl., Auki, *Colocasia* leaf, 18.X.1935. — Nggela Isl., Maliali, *Colocasia*, 23.XI.1933. — Shortlands, Morgusaia, *Colocasia*, 26.IV.1934. — Sa. Isabel Isl., 2.III.1934.

BRUNNER VON WATTENWYL has only mentioned this name in a list of species known to him from the Halmahera Island, but never described the species, and his name remains *nomen nudum*. KRAUSS mentions that *G. sanguinolenta* differs from *G. punctifrons* ST. in being more brightly coloured, with blood-red hind tibiae and sometimes orange-red hind femora, and he suggests that it is merely a "Lokalvarietät". Although this description is exceedingly meagre and may be applicable to more than one species, it is sufficient to make the name valid, and the Halmahera specimen (or specimens) in the BRUNNER collection, which has been studied by KRAUSS also, should be regarded as the type.

The specimens from the Solomon Islands do not appear to differ from those of New Guinea in the British Museum collection.

Oxya gavisa (WALKER, 1870).

Guadalcanal Isl., Doma; Kookom, 1931; Lunga estate, undergrowth, 9.VII.1933. — Tulagi Isl., VI.1933; lalang on ridge, 29.I.1935; ridge, 30.VII, 13.VIII, 2.IX.1933. — Nggela Isl., Maliali, 23.XI.1933. — Sa. Isabel Isl. — Russell Isl., Somata, 22.II.1933. — Vella Lavella Isl., Suanatali, Dobeli, 24.IX.1933.

Genus *Bumacris* WILLEMSE 1931.

1931. *Bumacris*, WILLEMSE, Intern. Entom. Ztschr. Guben, 1931, No. 34, p. 348.
1935. *Bumacris*, WILLEMSE, Stylops, *4*, p. 165.

In his first description of the genus WILLEMSE committed an error in describing the apical armature of hind tibiae. This he himself has corrected in his enlarged re-description, but in neither case has he discussed the systematic position of the genus. In my opinion, *Bumacris* should be placed quite near to *Tauchira* STÅL, with which it has many features in common, and more particularly the acute margins of the hind tibiae which are clearly expanded in the apical portion. The difference consists mainly in the structure of the prosternal tubercle which is simply conical in *Bumacris*, and strongly modified in *Tauchira*.

Three species have been described by WILLEMSE (*ll.cc.*), all from the Solomon Islands, and I have to add a fourth, strikingly different from the

others. Further studies on more abundant material, may show that some of them are only subspecies, but it is practically certain that collecting in various islands will increase the number of species and subspecies.

Bumacris leveri, sp. n.

♀. Antennae much longer than head and pronotum together.

Face distinctly oblique; coarsely but not deeply punctured. Frontal ridge not strongly raised, shallowly sulcate. Head above not punctured.

Pronotum relatively long, distinctly gibbose in the prozona which is 5/8 the length of the whole pronotum. Transverse sulci deep, distinctly projecting forward in the middle. Posterior angle obtuse. Surface with coarse honey-combe punctures. Lateral lobe distinctly longer than deep; coarsely punctured except for two smooth spots in the prozona.

Elytra reaching the base of hind knees.

Antennae black, fading to blackish-green basally. Face dark yellow; a large triangular spot above the clypeus and the frontal ridge black. Cheeks dark-yellow. Head above dark yellow, with a broad triangular median stripe and broad postocular fasciae black. Pronotum dark yellow, with a broad median stripe and more than the upper half of lateral lobes black. Pleurae dark-yellow below, black above. Sternum and abdomen below dirty-yellow and black. All femora reddish-black; posterior ones with a pale preapical ring and black knees. All tibiae bluish-black. Elytra of beautiful metallic-azure colour, with a greenish-yellow streak along the ulnar vein. Wings azure.

Length of body 36; pronotum 9; elytra 23; hind femur 22 mm.

Isabel Island, Tatamba, 30.VI.1935, on *Calamus* leaf, 1 ♀.

The striking striated pattern and the beautiful azure colour of elytra and wings make this species very easily recognisable.

Genus *Opiptacris* WALKER, 1870.

1870. *Opiptacris* **WALKER, Cat. Derm. Salt. Brit. Mus., IV, p. 650.**

1931. *Salomonacris*, **WILLEMSE, Intern. Entom. Zeitschr. Guben, No. 33, p. 336** (*syn. nov.*).

In describing *Salomonacris,* WILLEMSE has pointed out that it differs from *Cranaë* STÅL, 1878, by the complete absence of elytra and wings. In other papers he has described under *Cranaë* two species, *pictipennis* (Buru [Boeroe] Island; Treubia, VII, Suppl., 1932, p. 379) and *signata* (Solomon Islands, Stylops, *4*, 1935, p. 167), which differ from other known species of *Cranaë* by possessing minute scale-like elytra, without any trace of veins, and no wings. This is the condition observed in the only known species of *Opiptacris* (*O. hilaris* WALKER, *l.c.;* New Hebrides). We have, therefore, three very closely allied groups, as follows:—

1. *Cranaë*. Elytra more or less abbreviated, but with distinct venation; wings present.

2. *Opiptacris*. Elytra minute, scale-like, without any trace of veins; no wings.

3. *Salomonacris*. No elytra; no wings.

While the difference between typical *Cranaë* and *Opiptacris* is very clear and can be given generic value, the latter genus cannot be definitely separated from *Salomonacris* which presents merely an extreme case of the reduction of flight organs as observed in *Opiptacris*. I think, therefore, that *Salomonacris* should be united with *Opiptacris*, and it would comprise the following known species:

1. *O. hilaris*, WALKER, 1870. — New Hebrides.
2. *O. pictipennis* (WILLEMSE, 1932). — Buru (Boeroe) Island.
3. *O. signata* (WILLEMSE, 1935). — Malaita, Solomon Islands.
3a. *O. signata tulagii*, sbsp.n. (see below). — Tulagi, Solomon Islands.
4. *O. ruficeps* (WILLEMSE, 1931). — Malaita, Solomon Islands.
5. *O. atriceps* (WILLEMSE, 1931). — Malaita, Solomon Islands.

The last two species in the list may represent merely the opposite sexes of the same species, as suggested by WILLEMSE himself.

Opiptacris signata tulagii, sbsp. n.

Closely resembles the typical *signata* described from the Malaita island, but differs from it in the larger head and the colouration.

Antennae black, except the red basal joint. Head sealing-wax red, except the apex and sides of the fastigium and a triangular occipital stripe, which are black. Face red and yellow. Mouth-parts yellow, with black pattern. Pronotum black, with three dark-red spots on each side of prozonal disc; lateral lobe with the anterior angle yellow and the posterior red. Elytra minute, red. Legs black; posterior femur with a reddish-yellow preapical spot above.

Tulagi Island, 16.XII.34, 2 ♀♀ (one the type); 20.XII.34, 1 ♀; 26.I.35, 1 ♀. On *Pandanus*.

The Tulagi insects differ from the typical *signata* of the Malaita island by the different distribution of the red colour and by its shade, since in *signata* it is orange-red. There is also a striking difference in the size, particularly the width, of the head. This may be even a specific character, but one must study more material to decide on this point.

Modernacris callosa, sp. n.

♀ Antennae a little longer than head and pronotum together, with broad alternating yellow and brown rings.

Face strongly oblique; dark castaneous, covered with dense ivory-yellow callous tubercles. Frontal ridge represented by a narrow sulcus included between callous raised margins. Head above yellowish-brown, with indefinite brownish pattern; surface with scattered fine punctures; a smooth median longitudinal line. Eyes bulging sideways. Cheeks brownish-yellow, with a few pale callosities in the lower part.

Pronotum dirty olivaceous-brown, densely and rather coarsely punctured on the disc. Lateral lobes much longer than deep, with scattered and not very distinct, pale callosities, lower margin very weakly sinuate; lower posterior angle obliquely truncate. Posterior margin of pronotum narrowly black.

Abdomen yellowish-brown, with an interrupted blackish median line. Dorsal surface of mesonotum, metanotum and abdominal tergites in fairly dense punctures. Sternum and abdomen below brownish-black, shiny.

Anterior and middle legs yellowish-brown. Posterior femur of the same general colour, not marked on the outer side, darker on the inner side; lower sulcus violet-black. Posterior tibia light-red; base below, and apex on the inner side, blackened. Posterior tarsus very light reddish, fading to pale-yellow apically.

Length of body 36; pronotum 5; hind femur 17 mm.

Malaita Island, Su'u, jungle, 16.VIII.1934, 1 ♀.

There are two species known in the genus, both from the Solomon Islands. They are *M. controversa* Willemse (Intern. Entom. Ztschr. Guben, 1931, No. 33, p. 334) from the New Georgia island; and *M. simplex* Willemse (Stylops, *4*, 1935, p. 168) from the Savo island. The new species is more similar to *M. controversa* in its more slender general habitus, while *M. simplex* is a sturdier insect with definitely shorter pronotum. The presence of callosities on the face and pronotal lobes is a character separating the new species from the other two. It is not impossible that *M. callosa* is only a subspecies of *M. controversa*, but both species are known from single female specimens. In any case, it appears that the genus is represented on various islands either by different species, or subspecies.

Catantops angustifrons (Walker, 1870).

Guadalcanal Isl., Lunga, XI.1931; do., undergrowth, 9.VII.1933; Kaukau, 22.VIII.1934; Lunga, *Imperata*, 21.XII.1933. — Tulagi Isl., *lalang* on ridge, 29.I.1935. — Ganongal Isl., Emu Harbour, at light, 29.V.1934. — Vella Lavella Isl., Liani Estate, Dobeli, 23.IX.1933. — Nggela Isl., Maliali, snake beans, 23.XI.1933. — Savo Isl., 25.II.1934. — Russell Isl., Somata, 22.II.1934.

Valanga conspersa salomonensis Sjöstedt, 1931.

Tulagi Isl., VI.1933; 14.VII.1934, on *Hibiscus;* 25.VII.1934; 19.I.1934; 2.VIII.1934; 16.XII.1934; 29.I.1935; 6.II.1935. — Kulombongara, Kariftana Estate, 2.X.1933. — Gavutu, at light, 20.VI.1933. — New Georgia Isl., Segi, Marovo, 7.V.1934. — Vella Lavella Isl., Ruaravai, on *Cocos,* 1.VI.1934. — Sava Isl., on coconuts, 30.X.1933. — Malaita Isl., Mukka, 23.X.1934; Su'u, 24.V. 1934. — Russell Isl., Yandina, 16.II.1934.

General colouration not always green as stated in the original description, but often more or less brownish. Hind tibiae pale dirty-reddish above and dirty-olivaceous below; their spines yellow with black tips, not whitish as

described (probably from insufficiently well preserved specimens). There are no stable differences between specimens from different islands, except those from Malaita which bear heavier dark markings than usual.

Austracris guttulosa illepida (WALKER, 1870).

Tulagi Isl., *lalang* on ridge, 19.I.1935. — Guadalcanal Isl., Arutigo, 9.XII. 1934; Lunga, *Imperata,* 21.XII.1933.

There is no appreciable difference between the Solomon Islands specimens and the typical ones from the New Hebrides.

ADDITIONS TO THE ANT-FAUNA OF KRAKATAU AND VERLATEN ISLAND.

By

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Since my publication in 1924 on the ants of Krakatau and other islands in the Sunda Strait, [1]) Dr. K. W. DAMMERMAN has continued his investigation of their insect-fauna and has made an important contribution to the list of Formicidae. Twenty-one, or more than half of the forms which he has kindly sent me for identification, have not been taken heretofore either on Krakatau or Verlaten, and may be regarded as recent immigrants from Eastern Sumatra *via* Sebesi Island. The names of these additions are preceded by asterisks in the following pages. Twelve years ago 37 forms were known from Krakatau and 11 from Verlaten. Of the latter 9 were common to both islands. Hence in 1924 the total number of forms known to have established themselves on the two islands during the 41 years that had elapsed since their sterilization by the volcanic catastrophe of 1883, was 39. With the accessions recorded in this paper the number has risen to 60. It would seem, therefore, that the immigration of ants into Krakatau and Verlaten has been proceeding at somewhat more than an average rate of one species a year.

Ponerinae.

Odontoponera transversa F. SMITH.

☿ Krakatau, Nov. 1932 and April 1933.

Euponera (*Brachyponera*) *luteipes* MAYR.

☿ ♀ Krakatau, Jan. and April 1933; Verlaten, Jan. and Dec. 1933.

Ponera confinis ROGER var. *javana* FOREL.

☿ ♀ Krakatau, April 1933; ☿ Verlaten, Aug. 1930, Jan. 1933.

**Trapeziopelta breviloba* WHEELER.

Two winged females from Krakatau, April 1933, agree closely with the type from Borneo in my collection. The unknown worker must be structurally very similar to *T. bidens* EMERY from Sumatra, but this species is described as piceous, with ferruginous mandibles, funiculi, anus and leg-articulations, whereas *breviloba* is deep red.

**Anochetus punctiventris* MAYR.

☿ Krakatau, Nov. 1932.

[1]) Treubia 5, 1924, pp. 239 - 258.

**Anochetus taylori* FOREL.

☿ Verlaten, April and Dec. 1933. Previously recorded from Prinsen Island in the Sunda Strait.

Odontomachus haematoda L.

☿ Krakatau, April 1934; ☿ Verlaten, Jan. and Dec. 1933.

Pseudomyrminae.

Tetraponera (Sima) rufonigra JERDON.

☿ Krakatau, Dec. 1933, April 1934.

Myrmicinae.

Pheidole megacephala FABR.

♃ ☿ Verlaten, April and Dec. 1933.

**Pheidole hortensis* FOREL.

☿ Krakatau, April 1933.

***Pheidole nodgii verlatenensis**, subsp. nov.

Soldier. Length 2.3 - 2.4 mm.

Distinctly smaller than the typical *nodgii* FOREL and its subspecies *tjibodana* and *maxwellensis*. The head is more deeply impressed posteriorly than in *tjibodana* and more shining. Its sculpture is like that of the typical *nodgii*, the posterior corners being coarsely reticulate-rugose with finely reticulated interrugal spaces, the humeri are less acute, the mesonotal torus much less pronounced the epinotal spines decidedly shorter and the postpetiole proportionally longer, with less acute lateral angles. The color is black, like that of *tjibodana*, but the front, petiole, postpetiole and basal third of the first gastric segment are ferruginous.

Described from three specimens taken during January 1933 on Verlaten Island. These have been compared with numerous Javan topotypes of the typical *nodgii* and *tjibodana*, also collected by Dr. DAMMERMAN. FOREL described the latter as a variety but it seems to me to deserve subspecific rank. Judging from his description, *maxwellensis* from Malacca differs so much from the other forms of *nodgii* that it might be regarded as an independent species.

Pheidole miseranda WHEELER.

♃ ☿ Verlaten, April and Dec. 1933.

Worker (undescribed). Length 1.3 - 1.5 mm.

Head without the mandibles as broad as long, slightly narrowed anteriorly, with broadly rounded posterior corners and medially sinuate posterior border. Eyes convex, just in front of the middle of the sides. Mandibles with a single long apical tooth and several basal denticles. Clypeus convex, its anterior border straight and entire in the middle. Frontal area large, semicircular, with median carinula; frontal carinae straight, subparallel, as far apart as their distance from the lateral borders of the head. Antennal scapes thickened apically, reaching very slightly beyond the posterior border of the head. Pro- and mesonotum

forming together an evenly convex, hemispherical mass; epinotum much lower, slightly longer than broad, with subequal base and declivity, the spines suberect, half as long as the base. Postpetiole as broad in front as behind, its node blunt and rounded in profile, its summit from behind slightly convex. Postpetiole one and one-half times as broad as the petiole, broader than long, with feebly angulate sides. Gaster broadly elliptical, with truncated anterior border.

Mandibles shining, indistinctly striate; head, thorax and petiolar node subopaque, densely and evenly punctate ("thimble-punctured"); postpetiole, gaster and legs smooth and shining.

Hairs white, very sparse and rather short on the body, shorter, oblique and more numerous on the tibiae.

Head and thorax brownish ferruginous; abdomen, mandibles, antennae and legs paler and more yellowish; middle portions of femora and gaster posteriorly infuscated.

Described from ten specimens. The soldier type is from Krakatau.

Crematogaster (Acrocoelia) ferrarii EMERY.

☿ Krakatau, Oct. 1933; Verlaten, April 1933.

**Crematogaster (Acrocoelia) dohrni rogenhoferi* MAYR.

☿ Krakatau, April and Oct. 1933.

Crematogaster (Physocrema) deformis F. SMITH.

☿ Verlaten, Aug. 1930.

**Pristomyrmex brevispinosus* EMERY.

☿ Krakatau, April 1933.

**Triglyphothrix lanuginosa* MAYR.

☿ Krakatau, April 1933. Previously recorded from Prinsen Island.

**Tetramorium guineënse* FABR.

☿ Krakatau, Jan. 1933. Previously recorded from Sebesi Island.

**Tetramorium tonganum* MAYR.

☿ Krakatau, April 1933.

**Strumigenys godeffroyi* MAYR.

☿ Krakatau, April 1933.

Dolichoderinae.

**Iridomyrmex cordatus protensus* FOREL var. *butteli* FOREL.

☿ Krakatau, April 1934; ☿ Verlaten, Jan. 1933.

**Iridomyrmex cordatus fuscus* FOREL var. *jactans* FOREL.

☿ Krakatau, April 1933.

**Technomyrmex albipes* F. SMITH.

☿ Krakatau, Nov. 1932 and April 1933.

**Tapinoma sundaicum* EMERY.

☿ Verlaten, April and Dec. 1933.

**Tapinoma (Micromyrma) melanocephalum* FABR.

☿ Verlaten, Jan. 1933.

Formicinae.

Anoplolepis longipes JERDON.

☿♀♂ Krakatau, Nov. 1932; ☿ Verlaten, Nov. 1932 and 1933, Jan. 1933.

Oecophylla smaragdina FABR.

☿ Verlaten, Jan. 1933.

**Camponotus* (*Tanaemyrmex*) *festinus eximius* EMERY.

☿ Krakatau (DOCTERS VAN LEEUWEN), March 1, 1931; ♀ (DAMMERMAN), April 1933.

Camponotus (*Tanaemyrmex*) *irritans* F. SMITH.

☿ Krakatau, Jan. 1933, April 1934.

**Camponotus* (*Tanaemyrmex*) *irritans* var. *inferior* FOREL.

☿ Krakatau, April 1934.

Camponotus (*Myrmamblys*) *bedoti* EMERY.

☿ Krakatau, April 1934; ♃ ☿ Verlaten, Aug. 1930.

Camponotus (*Colobopsis*) *vitreus angustatus* MAYR.

♃ ☿ ♀ Krakatau, April 1933; Lang Island (DOCTERS VAN LEEUWEN), June 23 - 25, 1932.

Polyrhachis (*Myrmhopla*) *abdominalis* F. SMITH.

☿ Krakatau, Nov. 1932, April 1933.

Polyrhachis (*Myrmhopla*) *dives* F. SMITH.

☿ Krakatau, Oct. 1933.

Polyrhachis (*Myrma*) *mayri* ROGER.

☿ Krakatau, Nov. 1932, Oct. 1933, April 1934.

Polyrhachis (*Myrma*) *proxima* ROGER.

☿ Krakatau, Dec. 1933, April 1934.

**Pseudolasius familiaris* F. SMITH.

☿ Krakatau, April 1934.

**Pseudolasius minutus* EMERY.

♀♂ Krakatau, April 1933.

**Nylanderia bourbonica bengalensis* FOREL.

☿ Verlaten, Jan., April and Dec. 1933.

Nylanderia taylori FOREL.

☿♀ Krakatau, April 1933; DOCTERS VAN LEEUWEN, June 13, 1929; ☿ Verlaten, Dec. 1933.

ON SOME NEW SPECIES OF *CARABIDAE*, CHIEFLY FROM JAVA (III).

By

H. E. ANDREWES

(London).

In this third paper [1]) will be found the descriptions of some further new species of *Carabidae,* collected this time by Mr. F. C. DRESCHER of Bandoeng. Fourteen new species are described and one new genus, among the former being representatives of the genera *Dromius* and *Calathomimus,* both, so far as I am aware, new to Java. Mr. DRESCHER has kindly allowed me to retain the type specimens in my collection.

Java appears to be rich in *Carabidae,* and, as in the case of some other islands in the Archipelago, the genus *Colpodes* is particularly well represented. Not many Javan species of this genus have hitherto been described, nor are any new ones described here, but I am hoping to be able to deal with them in a future paper.

Tachys zoster sp. n.

Length: — 2 mm.

Ferruginous: a dark band across the middle of the elytra, the apex also slightly infuscate.

Head with rather shallow, linear furrows, diverging slightly behind, eyes rather flat, antennae slender, hardly extending beyond base of elytra. *Prothorax* convex, a half wider than head, quite two thirds wider than long, base truncate, much wider than apex, very little contracted behind, sides finely bordered and gently rounded, hind angles right and fairly sharp, without carina; basal sulcus fine and shallow, not crenulate, with two pores at middle. *Elytra* convex, oval, the border smooth, a third wider than prothorax, a fourth longer than wide; stria 1 entire, fairly deep, and finely crenulate, 2 visible as far as middle, 3 indicated by one or two fine pores in front, 8 impressed near apex only, striole short, curved, on middle of elytron, the pore half way along it, a single minute dorsal pore a little behind middle. No microsculpture. Metasternal process deeply bordered; claws clearly denticulate.

In my "Revision of the Oriental species of the genus *Tachys*" (Ann. Mus. Civ. Gen. li. 1925) this species would come into the *haliploides*-group (p. 470)

[1]) For my two former papers see:
Treubia vol. xiv. 2. 1933, pp. 273-286.
Treubia deel 15. 3. 1936, pp. 211-224.

and is near *striatulus* m., but the character of the elytral striation, and the broad black band across the elytra distinguish it both from that species and from *haliploides* BATES.

Res. Preanger: G. Tangkoeban Prahoe, 4000 - 5000 feet. 2 ex.

Calathomimus drescheri sp. n.

Length: — 7.25 - 8.25 mm.

Black, shiny: palpi, antennae, legs, reflexed margin of prothorax, and border and epipleura of elytra ferruginous.

Head convex, frontal foveae small and diverging behind, eyes moderately prominent, antennae extending a little beyond base of elytra. *Prothorax* moderately convex, subquadrate, nearly two thirds wider than head, a third wider than long, more contracted in front than behind, base and apex both emarginate, front angles only slightly rounded, sides each with a single seta at two fifths from apex, finely bordered and gently rounded, explanate and reflexed behind, so that the marginal channel meets the base at some little distance from the angle, hind angles obtuse and rounded, the surface adjoining them somewhat raised; median line moderately deep, the other normal impressions obsolete, surface impunctate, a little uneven near base. *Elytra* elongate, slightly wider than prothorax, nearly two thirds longer than wide, sides straight and parallel at middle, basal border strongly bisinuate, forming an acute angle at each shoulder; striae deep, very finely and indistinctly crenulate, intervals convex, 6 and 7 subcostate close to base, 3 with three or four pores adjoining stria 2, none on 5 or 7. Microsculpture of the elytra formed by very wide meshes; on the prothorax the meshes are not so wide, but faint and irregular; none on the head.

In spite of some slight differences, including a lack of pattern on the elytra, I see no reason to exclude this species from BATES' genus, the species of which are known otherwise only from Ceylon; as in *C. vittatus* ANDR., the seriate punctures on the elytra are confined to the third interval.

Res. Preanger: G. Tangkoeban Prahoe, 1400 - 1600 m, 12 ex.

Calathomimus limatus sp. n.

Length: — 10.5 mm.

Black, shiny, very faintly iridescent: palpi, antennae, and legs ferruginous.

Head small, convex, frontal foveae slight, diverging behind, eyes only moderately prominent, antennae slender, extending rather beyond base of elytra. *Prothorax* convex, subquadrate, about two thirds wider than head and a fourth wider than long, base wider than apex, both a little emarginate, front angles moderately sharp, sides each with a single seta at a third from apex, sides very finely bordered and rounded, explanate, much more widely behind, where they are also somewhat reflexed, hind angles obtuse and rounded; median line very fine, visible only on disk, the other impressions obsolete, surface smooth and impunctate, basal area a little uneven. *Elytra* convex, elongate, as wide

as prothorax, twice as long as wide, sides very gently rounded, widest just behind middle, basal border bisinuate, forming an acute angle at each shoulder; striae deep, impunctate, scutellary striole fairly long, arising in an umbilicate pore, intervals convex, more convex at sides and apex, 3 with three pores, adjoining stria 2, none on 5 or 7. Microsculpture of the prothorax and elytra formed by excessively fine transverse lines; on the head isodiametric meshes are just visible.

Larger than *C. drescheri* described above, and, like it, without any pattern on the elytra, the sides of the prothorax more rounded, more reflexed behind, the hind angles more rounded, the elytra longer, the striae neither punctate nor crenulate.

Res. Banjoemas: G. Slamat, Batoerraden, 800 m, 1 ex. ♀.

Carbanus gen. n.

Body winged. *Head* with the eyes adjoining the buccal fissure, one supra-orbital seta not far from the eye; labrum sexsetose, slightly emarginate, clypeus bisetose and also slightly emarginate; mandibles short, curved, very sharp at apex, right one with a powerful tooth nearer apex than base, left one edentate; mentum with a short wide tooth in the emargination, submentum with a long seta on each side; ligula bisetose, a little dilated at apex, paraglossae membranous, free, glabrous, rounded at apex, a little narrower and shorter than ligula, maxillae hooked and fringed with bristles; palpi sparsely setulose, pointed at apex, maxillaries with the apical joint a half longer than the penultimate, equal in the labials, the penultimate joint in the latter plurisetose; antennae setose from joint 3 inclusive. *Prothorax* quadrate, the base vaguely bordered at sides, the border sometimes just traceable at middle, the sides unisetose. *Elytra* nine-striate, the basal border entire. Prosternal process unbordered at apex, with one or two minute setae; metasternum longitudinally sulcate, the process bordered, the episterna a half longer than wide. Venter with a smooth oblong foveole in the middle of base in both sexes, apical segment with a single marginal seta on each side in the ♂, 2 in the ♀. Protibiae only a little dilated towards apex, with an outer row of fine bristles; metatarsi not outwardly sulcate, joint 1 as long as 2 + 3: tarsal joints glabrous above, joint 4 only slightly emarginate, joint 5 not setulose beneath: protarsi ♂ with four moderately dilated joints, clothed with whitish scales beneath, mesotarsal joints also dilated to a moderate extent.

This new Harpaline genus presents an unusual combination of characters. In appearance it is somewhat like *Tachycellus*, but wider and with sharper hind angles in the prothorax.

Carbanus flavipes sp. n.

Length: — 6 mm. Width: — 2.6 mm.

Black, shiny: buccal organs, antennae, and legs flavous; border of prothorax, apex of elytra, and pro- and epipleura vaguely ferruginous.

Head convex, eyes prominent, clypeal suture very fine, frontal foveae short, moderately impressed, continued on each side as a fine line to the eye, antennae extending somewhat beyond the base of the elytra. *Prothorax* convex, rather less than a half wider than head, a half wider than long, very slightly contracted behind, so that the base is much wider than apex, sides finely bordered, rounded in front, nearly straight behind, the pore and seta at two fifths from apex, hind angles slightly obtuse but very little rounded; median line shallow, transverse impressions obsolete, basal foveae wide and very shallow, basal area finely and rather sparsely punctate, the puncturation running forward to middle at sides. *Elytra* convex, nearly a third wider than prothorax, though the base is hardly wider than the base of the prothorax, rather more than a half longer than wide, sides straight and parallel at middle; striae rather fine, impunctate, scutellary striole fairly long, between striae 1 and 2, arising along with 2 in an umbilicate pore; intervals nearly flat, 3 with one very small pore, adjoining stria 2, at three fifths from base. Microsculpture of the elytra formed by very fine wide meshes; traces only on the head and prothorax.

Res. Preanger: G. Tangkoeban Prahoe, 1400 - 1600 m, 10 ex. ♂ ♀.

Lesticus drescheri sp. n.

Length: — 16 mm. Width: — 5.8 mm.

Black beneath: antennae, palpi (ferruginous at extremity), and tarsi piceous; head and prothorax purple, the border of the latter greenish; elytra rather bright blue.

Head convex, neck faintly constricted, frontal foveae deep, irregularly striate, not quite reaching hind-eye level, some deep longitudinal striae near eyes, one or two oblique striae on front, eyes moderately prominent, genae conspicuous but shorter than eyes, palpi (♀) very slender, the apical joint not dilated, antennae extending a little beyond base of prothorax. *Prothorax* convex, a little wider than head and about a third wider than long, base truncate, its sides somewhat oblique, apex faintly emarginate, evidently wider than base, sides bisetose, well rounded in front, sharply sinuate at a fifth from base, border moderately thick and conspicuously crenulate, hind angles rectangular, but not very sharp, projecting a little laterally; median line moderately deep on disk, not reaching extremities, basal foveae deep, close to the angles, converging slightly in front, surface faintly transversely striate, basal area very finely rugose. *Elytra* convex, a little less than a third wider than prothorax, a half longer than wide, dilated behind and widest at middle, the sides slightly emarginate on each side behind the shoulders, which are square, though rather narrow, no basal border, the side border joining stria 6 at base; striae deep, very deep at sides, impunctate, intervals convex, very convex at sides, 7 narrower and 8 much narrower than the other intervals, almost costate, 3 with two pores, at about a fourth and just behind middle. Microsculpture isodiametric, fairly conspicuous on the elytra, fine and faint on the head, practically none on the prothorax. Underside smooth; metepisterna barely longer than wide; last ventral

segment (♀) with two pores on each side; joint 1 of the metatarsi finely outwardly sulcate, joint 5 with setae beneath.

In form similar to *L. janthinus* DEJ., but easily distinguished from any other Javan *Lesticus* s.s. by the greenish crenulate border of the prothorax, the blue elytra, and the deep, impunctate striae.

Res. Banjoemas: G. Slamat, Batoerraden, 800 m, 1 ex. ♀.

Abacetus spissus sp. n.

Length: — 5 mm.

Black, venter brown: palpi, joints 1 to 4 of antennae, tibiae, and tarsi more or less ferruginous.

Head convex, smooth, a small fovea on vertex, clypeal suture distinct, frontal foveae fairly deep, diverging behind but curving slightly inwards at the extremities, eyes moderately prominent. *Prothorax* convex, three fifths wider than head, a fourth wider than long, base truncate, hardly wider than apex, front angles fairly sharp, sides bisetose, strongly rounded, faintly sinuate quite close to the hind angles, which are sharp, though slightly obtuse; median line and basal foveae moderately impressed, the latter rather short, linear, and nearly parallel, joining the fairly wide lateral channels along sides of base, surface smooth, a few small punctures between the foveae. *Elytra* convex, shoulders square, sides parallel at middle, a fourth wider than prothorax, a half longer than wide; striae fairly deep, impunctate, 2 arising in an umbilicate pore; intervals rather convex, a single small dorsal pore on 3, adjoining stria 2, surface smooth. Microsculpture of the elytra formed by very wide meshes, the meshes less wide on the prothorax, isodiametric on the head. Underside smooth, prosternum sulcate, both pro- and metasternal processes bordered, the former at apex only, metepisterna a little longer than wide, metatarsi not sulcate, claw-joint without setae beneath.

A little smaller than *A. amplipennis* BATES, though similar in form, but the frontal foveae, which in BATES' species curve round on each side to the eye, here curve outwards and then inwards; the prothorax is similar, but with a deeper median line; the elytra are evidently shorter and very convex, and the femora are dark instead of pale.

Res. Banjoemas: Koebangkangkoeng, 1 ex. ♂.

Dicaelindus longimalis sp. n.

Length: — 11 - 12 mm.

Black, shiny, with only a trace of iridescence: palpi, and basal half of joint 1 of antennae ferruginous; rest of antennae and tarsi piceous.

Head smooth, rather flat in front, frontal foveae short, moderately deep, diverging behind, eyes moderately convex, mandibles exceptionally long and straight, but curving inwards at apex, the upper margin of the scrobe of the right mandible somewhat dilated at base in both sexes, antennae stout, extending

rather beyond base of elytra, joint 3 hardly longer than 4. *Prothorax* moderately convex, quadrate, rather less than a half wider than head, exactly a third wider than long, base slightly arcuate, wider than apex, sides gently rounded, border narrow in front, a good deal wider behind, a pore and seta just within the hind angles, which are slightly obtuse and a little rounded; median line very faint, basal foveae short, linear, parallel, fairly deep, not reaching base, surface smooth. *Elytra* convex, ovate, with square shoulders, rather more than a fourth wider than prothorax, a half longer than wide, only a faint sinuation on each side behind; striae moderately deep, impunctate, 2 arising in an umbilicate pore, intervals moderately convex on disk, more convex near apex, where 7 and 8 are subcarinate, no dorsal pores, surface smooth. The microsculpture of the elytra is formed by very fine irregular transverse lines; on the disk of the prothorax it is isodiametric or nearly so, and further the whole of the upper surface is microscopically punctulate. The underside is finely punctulate at sides; prosternal process (at extremity only) and metasternal process finely bordered, the metepisterna much longer than wide and externally bordered; last ventral segment with one marginal seta on each side in the ♂, two in the ♀; tarsal joint 5 glabrous beneath.

Remarkably like *D. omestes* ANDR. from Sumatra, but differing in some important particulars. In the new species only the basal half of antennal joint 1 is ferruginous, instead of the whole of joints 1 and 2, and joint 3 is barely longer than 4. The mandibles are much longer and straighter, the upper margin of the scrobe dilated at the base, instead of in the middle. The marginal channel of the prothorax is continued on each side to base, the pore and seta on the inner side, whereas in *omestes* the channel almost disappears just before base, and the pore and seta are on the angle.

Res. Preanger: Patimoean (F. C. DRESCHER), 13-20.vii.1925. 4 ex. Res. Kediri: Bandoeng (C. J. LOUWERENS), 2 ex., and Zuider Geb., Popoh (C. J. LOUWERENS), 1 ex.

Pogonoglossus torvus sp. n.

Length: — 10 - 11.75 mm.

Piceous: venter, palpi, and tarsi dark reddish; body pubescent.

Head convex and shiny, with a few punctures on each side behind, and one or two on disk, frontal foveae deep and wide, containing one or two fine punctures, neck deeply constricted, eyes rather small, a small setulose tubercle on each side just behind them, genae longer than eyes, not projecting quite so far, and curving round rather sharply to neck, mandibles long, antennae stout, reaching basal third of elytra. *Prothorax* cordate, rather flat, nearly a fourth wider than head, not much wider than long, widest at about a third from apex, base with slightly oblique sides, hardly wider than apex, which is rather deeply emarginate, sides unbordered and widely reflexed, strongly rounded in front, sinuate at a third from base, a pore and seta on each side at the widest point

and another on the hind angle, where the pore makes a slight indentation, hind angles sharp, reflexed, and slightly obtuse; median line and front transverse impression fairly deep, surface finely and sparsely punctate, an oval impression on each side on front of disk, with a faint, longitudinal, raised line just outside it. *Elytra* rather flat, quadrate, two fifths wider than prothorax, about a half longer than wide, widest just behind shoulders, the truncature at apex faintly emarginate on each side; striae fairly deep and finely punctate, a fairly long scutellary striole; intervals convex on disk, flatter behind, surface finely and not very closely punctate, shiny in spite of the sub-erect pubescence, a few very long hairs issuing on each side from the pores of the marginal series. Microsculpture of the elytra formed by rather irregular transverse lines making wide meshes; practically none visible on the head or prothorax. Underside more finely and sparsely punctate than the upper surface; metasternum with a longitudinal sulcus, its sides rather more strongly punctate, metasternal process bordered; metepisterna somewhat longer than wide.

Quite distinct from, and larger than any of the species hitherto described from Java or Sumatra. About the same size as *P. truncatus* ANDR. from Burma and Indo-China; the head with deeper frontal foveae and longer genae, the prothorax with its sides more widely explanate and more reflexed, the elytra similar in form, but, like the rest of the upper surface, much less closely punctate.

Res. Preanger: G. Tangkoeban Prahoe, 4000 - 5000 feet (F. C. DRESCHER), 3 ex. Res. Buitenzorg: Poentjak pass, Telagawarna, 1450 m (M. A. LIEFTINCK), 1 ex.

Sfitakantha reflexa sp. n.

Length: — 9 mm. Width: — 3.5 mm.

Black: reflexed margins of prothorax and legs (to some extent) piceous; palpi, joints 1 and 2 of the antennae (rest brown), base and apex of tibiae, and tarsi more or less ferruginous.

Head convex, with fairly long, slightly divergent, frontal impressions, eyes prominent, antennae slender, not extending very far beyond base of elytra. *Prothorax* slightly convex, cordate, two fifths wider than head, about a fourth wider than long, base slightly, apex deeply emarginate, sides unbordered, rounded in front, straight behind, widely explanate, the explanate part strongly reflexed, hind angles a little obtuse, but not very much rounded; median line fine but moderately deep, transverse impressions deep, disk faintly transversely striate, sides and base finely punctate-strigose. *Elytra* moderately convex, subquadrate, three fifths wider than prothorax, not quite a third longer than wide, an impression on each side a little behind shoulder, and another near apex between stria 3 and stria 5, apex obliquely truncate, slightly emarginate on each side, outer angles rounded, a re-entrant angle at apex; striae deep, vaguely crenulate, intervals convex, very convex near apex, a boss at the apex of 3, and a slighter boss at the point where 5 and 6 join, 3 with three small pores close to stria 2, at about a half, three fourths, and near apex respectively. Microsculpture of

the head and elytra isodiametric; on the prothorax the meshes are on average two to three times as wide as long.

Very similar to, though a little larger than *S. impressa* SCHM.-GOEB., the head and elytra hardly presenting any differences; the prothorax has much more rounded front and hind angles, and the sides are more contracted behind, widely explanate and strongly reflexed.

Res. Banjoemas: G. Slamat, 800 m, 4 ex.

Dromius hilarus sp. n.

Length: — 4 - 4.5 mm.

Ferruginous, darker beneath; palpi, antennae, legs and upper surface, including elytral intervals 8 and 9, paler; elytra otherwise piceous, with two flavous spots on each, the front one elongate-oval, extending from stria 2 to stria 6, the hind one more or less rounded, extending from stria 3 to stria 7.

Head small, convex, frontal foveae short but moderately impressed, eyes not prominent, antennae submoniliform, extending a little beyond base of elytra, mentum with a short, very obtuse tooth. *Prothorax* convex, about a third wider than head and as much wider than long, base truncate, much wider than apex, front angles rounded, sides hardly bordered, slightly reflexed, a little explanate behind, rounded in front, faintly contracted but not sinuate behind, a single lateral seta on each side on the hind angle, which is slightly obtuse but not much rounded; median line fine, basal foveae moderately deep, faintly rugose-punctate, surface vaguely transversely striate. *Elytra* rather flat, subquadrate, three fifths wider than prothorax and as much longer than wide, apex truncate, border becoming obsolete opposite stria 4; striae shallow, indistinctly crenulate, intervals slightly convex, 3 with a single pore near apex, 7 with three or four pores on the apical half, adjoining stria 6, not clearly distinguishable, as the surface here is very uneven. Last dorsal segment emarginate on each side; last ventral segment with two marginal setae on each side in the ♂, three in the ♀; claws strongly denticulate.

Res. Preanger: G. Tangkoeban Prahoe, 1400 m, 10 ex. Res. Banjoemas: Batoerraden, G. Slamat, 800 m, 1 ex.

This is the first species of the genus to be described from the Malay Archipelago. Like *D. indicus* ANDR. it has four spots on the elytra, but both the insect itself and the elytral spots are much smaller.

Metabletus javanus sp. n.

Length: — 3.5 mm.

Black: palpi, joint 1 of antennae, and legs flavous; rest of antennae and epipleura ferruginous; each elytron with two fairly large flavous spots, the shoulder spot comma-shaped, widening behind to stria 3, the apical spot long, extending inwards to stria 4, curving inwards and narrowing at apex, where the two apical spots join. In effect the elytra are flavous, with a large black cross, the upright widening round scutellum and not quite reaching apex.

Head smooth, with a slight fovea on each side at the ends of the faint clypeal suture, eyes moderately prominent. *Prothorax* subcordate, a fifth wider than head and fully a half wider than long, base a little produced at middle, its sides oblique, sides bisetose, strongly rounded in front, nearly straight behind, the hind angles sharp, but a little obtuse, and rather strongly reflexed; median line at middle and basal sulcus well marked, surface smooth. *Elytra* rather flat, subovate, not quite three fourths wider than prothorax, a fourth longer than wide, truncate behind, leaving the abdomen exposed; striae impunctate, the inner ones moderately impressed, the outer ones very fine, 1 to 3 reaching apex, but none quite reaching base; intervals a little convex on disk, 3 with two pores adjoining stria 3, at two fifths and three fourths respectively. Microsculpture of the elytra and sides of prothorax formed by very wide meshes; on the disk of the prothorax and the head the meshes are isodiametric. Claws very clearly pectinate.

Allied to *M. arrowi* Jedl. from the Philippine Is., but the antennae are pale, and the markings on the elytra differ, the black sutural stripe being carried almost to apex.

Res. Semarang: G. Oengaran, Djoemblang, 150 m, 1 ex. ♂.

Risophilus drescheri sp. n.

Length: — 3.75 - 4 mm.

Pale ferruginous: head, disk of prothorax, and sutural and marginal intervals of elytra dark ferruginous; sides of prothorax and greater part of elytra piceous; on each elytron at about two thirds is an elongate, oval, flavous spot, extending from stria 1 to stria 4. Surface glabrous.

Head convex, smooth, neck deeply constricted, frontal foveae short and shallow, eyes fairly prominent, antennae reaching basal fourth of elytra, mentum with a long sharp tooth in the emargination. *Prothorax* evidently narrower than head and slightly narrower than long, widest a little before middle, base slightly wider than apex, its sides very oblique, sides bisetose, narrowly bordered, gently rounded in front, strongly sinuate before base, hind angles sharp, though a little obtuse, and projecting laterally; median line and transverse impressions moderately developed, surface faintly transversely striate. *Elytra* rather flat, subquadrate, fully two and a half times wider than prothorax and fully a half longer than wide, apical truncature faintly emarginate on each side, border extending inwards to a point opposite stria 3; striae fairly deep, vaguely crenulate, intervals slightly convex, 3 with two pores, at a fourth, and four fifths. Microsculpture isodiametric throughout and very distinct. Ventral segments sparsely setulose, sixth segment ♂ deeply emarginate at middle, exposing a seventh segment, a single seta on each side, two setae in the ♀; claws strongly denticulate.

Not much like any other eastern species, and easily recognizable by the two pale oval spots on the elytra.

R e s. B a n j o e m a s: Batoerraden, G. Slamat, 800 m (F. C. DRESCHER), 2 ex.; R e s. P r e a n g e r: G. Goentoer, 1600 m (F. C. DRESCHER), 1 ex.; R e s. B u i t e n z o r g: Tjibodas, G. Gedeh, 1400 m (L. J. TOXOPEUS), 2 ex.

Risophilus leptosomus sp. n.

Length: — 5 mm.

Rather pale ferruginous: head and prothorax reddish, lateral borders of the latter and suture of the elytra brown.

Head wider than in *R. drescheri,* the neck less deeply constricted, the eyes more prominent, a rounded fovea present on each side of front. *Prothorax* long and narrow, the width at hind angles practically the same as in front, the base produced at middle, the sides only faintly rounded and more reflexed, the front seta very near the front angle, its pore breaking the outline of the border, the hind angles larger and projecting further laterally. *Elytra* a little more convex, only two and a quarter times wider than prothorax, but very nearly twice as long as wide, the striae a little shallower, rather more evidently crenulate, and showing vague underlying brown pores, interval 3 with similar pores. The microsculpture is the same, but on the prothorax the meshes are on average a little wider than long. Venter and claws as in *drescheri.*

Not unlike *R. inornatus* ANDR. from Sumatra, but a narrower and longer species, with more prominent eyes, the prothorax subquadrate, the elytra relatively longer and more deeply striate.

R e s. B e s o e k i: Bajoekidoel, G. Raoeng, 450 - 700 m (F. C. DRESCHER), 2 ex.; Idjen Plateau, Blawan Coffee Estate, 900 - 1500 m (H. LUCHT), 1 ex. R e s. B a n j o e m a s: Batoerraden, G. Slamat, 800 m (F. C. DRESCHER), 2 ex.; Noesa Kambangan Island (F. C. DRESCHER), 1 ex.

Pentagonica nitens sp. n.

Length: — 5 mm.

Black, shiny: border of the elytra ferruginous, joints 2 to 11 of antennae and legs flavous, but the femora are piceous, except at apex, and the middle of the tibiae is sometimes infuscate.

Head convex, a small impression on each side of front, adjoining the supraorbital pore, eyes flat, genae as long as eyes, curving evenly round to the deep neck constriction, antennae stout, reaching a little beyond base of elytra. *Prothorax* pentagonal, convex, a fifth wider than head, a half wider than long, base produced at middle, apex emarginate, bordered, front angles rounded, sides bordered and slightly reflexed, angulate a little before middle, with a pore (and seta) on the angle, rounded in front, straight behind, but sinuate close to base; median line fine, basal sulcus deep, surface very smooth, basal area finely rugose. *Elytra* convex, widely oval, nearly twice as wide as prothorax, two fifths longer than wide, base emarginate at middle, apex slightly truncate; striae very shallow, finely punctate, intervals slightly convex, 3 apparently

with three dorsal pores, which, owing to their minute size, are extremely difficult to trace. Microsculpture of the head and elytra isodiametric; prothorax without any, except along the base.

Not unlike *P. blanda* ANDR., also a Malay species, but more shiny, the eyes flat and the form of the head subglobular, the prothorax widest before the middle.

Res. Preanger: G. Tangkoeban Prahoe, 1400 m, 5 ex. Res. Buitenzorg, Poentjak pass, 1450 m (Buitenzorg Mus.), 1 ex.

with three dorsal pores, which, owing to their minute size, are extremely difficult to trace. Microsculpture of the head and elytra isodiametric; prothorax without any, except along the base.

Not unlike *P. blonda* Andr., also a Malay species, but more shiny, the eyes flat and the form of the head subglobular, the prothorax widest before the middle.

Ges. Fuesseger: O. Tangtschen Pashee, 1400 m, 1 ex. Ges. Bultensorg: Pounlisk pass, 1450 m (Bultenzorg Mus.), 1 ex.

NOTES ON A COLLECTION OF *SPHINGIDAE* COLLECTED BY MESSRS. M. AND E. BARTELS IN JAVA (Lep.).

By

M. A. LIEFTINCK

(Zoölogisch Museum, Buitenzorg).

The following is an enumeration of a small but very interesting collection of Javan *Sphingidae,* made by the sons of the late Mr. M. E. G. BARTELS, the well known ornithologist, and their mother, at Pasir Datar near Soekaboemi, West Java.

The collecting-ground is the factory-site of the tea-estate "Pasir Datar" on the southern slope of Mt. Panggerango-Gedeh, situated at an altitude of about 1000 metres above sea-level. With few exceptions the material dealt with in the following list was caught at two powerful lamps of the factory-building, from the close of the year 1913 till the end of 1915. About one-third of the specimens captured bear a locality-label "Po., Februari 1915" (Panggerango, February 1915), and there are also a few specimens taken by Mrs. BARTELS previous to 1915.

The opportunity has been taken of incorporating in these notes some unpublished records of Javan specimens of *Sphingidae* in the Buitenzorg Museum collection.

My sincere thanks are due to Dr. MAX BARTELS Jr., who placed the specimens into my hands allowing me to deposit the whole collection in the Buitenzorg Museum.

I have to acknowledge with gratitude the ready help of Dr. KARL JORDAN to whom a few of the more difficult species were sent for his judgment.

Subfam. ACHERONTIINAE.

1. **Herse convolvuli** (L.).

2 ♂, 3 ♀. One of the males taken in February, 1915.

2. **Megacorma obliqua** (WLK.).

1 ♀.

As compared with two fresh females in the Buitenzorg Museum collection caught by myself at light in Buitenzorg (Jan. 19 and Febr. 17, 1933), the colours of the actual specimen are slightly faded.

In fresh individuals the dark oblique stripe on the upperside of the fore wing is dark brownish-black or black, and most of the hind wings above is "bone-brown" (RIDGWAY). The fore wings of the Buitenzorg specimens measure 70 and 68 mm respectively, while those of the actual female are 65 mm long.

Dr. DAMMERMAN took a male of this rare species on Krakatau I., in December, 1919; fore wing 52 mm.

3. **Acherontia lachesis** (F.).
8 ♂, 3 ♀.

4. **Acherontia styx crathis** R. & J.
1 ♂.

5. **Psilogramma menephron** (CR.).
1 ♂. Not differing from Buitenzorg specimens.

Subfam. AMBULICINAE.

6. **Compsogene panopus** (CR.).
1 ♀.

7. **Oxyambulyx pryeri** (DIST.).
1 ♂, 1 ♀, dated February 1915.

As has been pointed out by JORDAN (Novit. Zool. 35, 1929, p. 60 - 62, pl. III), the male of this species may be distinguished from *O. substrigilis* (WESTW.) by the shape and armature of the 7th abdominal sternite, the median lobe of which is not short with the apical margin turned dorsad, as in *substrigilis*, but about as long as it is apically broad. The conical projections on the lateral angles of the margin, though directed upwards more or less distinctly, are well visible in postero-ventral view (cf. JORDAN's fig. 4 on pl. III, loc. cit.).

The presence or absence of a dark subbasal spot in the submedian space of the fore wing appears to be of no specific value. In our ♂ it is quite distinct, pale brown surrounded by a light ring, but in the ♀ it is entirely absent. The development of the dark median and postmedian lines in the fore wing is also very variable.

The only other Javan specimen in the Buitenzorg Museum is a large ♂ from Malabar (W. Java), P. A. OUWENS leg., in which the spot is obsolete.

Measurements of fore wing: ♂ Pasir Datar 54
♂ Malabar 61
♀ Pasir Datar 71 mm.

In the Buitenzorg Museum collection is a ♀ bred by Mr. L. HUNDESHAGEN at Loeboek Sikaping (W. Sumatra, ca 450 m alt.), June 18, 1924, which is smaller than the ♀ from Pasir Datar. Its fore wing measures only 56 mm. It differs from the Javan ♀ by the presence of a large olive-black subbasal spot to the fore wing and by the transverse median and postmedian blackish-brown lines being hardly visible (except on anterior border of the wing). Dr. JORDAN kindly confirmed the identification of this example [1]).

[1]) In this connexion it is worthy of note that ROTHSCHILD (Ann. Mag. Nat. Hist. 5, 1920, p. 479) described from Sumatra as *pryeri sumatranus* an example that would differ from typical *pryeri* (N. Borneo) by the better development of the undulated median and antemedian lines of the fore wing, the black basal mark and transverse bands of the hind wing being also more conspicuous.

8. **Oxyambulyx liturata** (Btlr.).

1 ♀, dated February 1915.

(1 ♀, Buitenzorg, 250 m alt., 1934, Mus. Buitenzorg).

Pasir Datar. — Corresponds closely with the drawing of a ♀ in Seitz (pl. 61b), except that the subbasal spot of the fore wings is a little smaller and cinnamon-coloured, not black. It differs further in that the fore wings and the body have a very distinct violet-grey gloss (mentioned already by Rothschild & Jordan in the Revision, p. 200).

The specimen is remarkable in that the hind wings are diffusely brownish on middle, at base. Fore wing 52 mm.

Buitenzorg. — Similar to the preceding specimen but with the subbasal spot of fore wing dark brown and much enlarged (diameter 2.8 mm). Hind wing at base with ill-limited brown colouring. Fore wing 55 mm.

So far as I am aware this species has not previously been recorded from Java. Very similar in size and colouring to certain individuals of *pryeri* but easily distinguished therefrom by the dark reddish-brown submarginal line which borders the grey marginal band of the fore wing beneath.

9. **Oxyambulyx sericeipennis joiceyi** Clark.

1923. Clark, Proc. New Engl. Zoöl. Club., 8, 1923, p. 70 (*O. joiceyi*).

1 ♂, dated February, 1915.

The only specimen of this rare insect is in excellent state of preservation. Originally described from S. W. Sumatra (Mt. Korintji, 7300 ft. and North Korintji Valley, 5000 ft.) as a distinct species but considered as a subspecies of *sericeipennis* by Dr. Jordan, who identified our example as *joiceyi*. Dr. Jordan tells me (in litt.) that our specimen does not exactly agree with the single one he has from the typical locality in Sumatra, but the difference, according to him, is due to the Sumatran specimen being quite fresh and therefore showing the blackish marking [obviously the subbasal round patch of the fore wing, M.A.L.] less distinctly than our specimen.

On comparing Clark's description with the ♂ before me, I notice that the latter differs from the Sumatran specimens chiefly in the great development of the subbasal round patch on the middle of the fore wing, this having a diameter of 2.8 mm. This spot is placed under (not beyond) the subbasal costal spot, which itself is not "semilunar" but rather lozenge-shaped and placed about 6 mm (not 4 mm) distant from the wing-base. The apex of the fore wing is very strongly produced, almost falcate. Our specimen bears a striking resemblance to that of typical *sericeipennis* from Sikkim, photographed on Pl. IX fig. 2 in Rothschild & Jordan's Revision (Novit. Zool. 9, 1902, Suppl.), except that the basal spots of the fore wing are larger and in the character of the narrowly produced apices of the fore wing.

Length of fore wing 50, greatest width 18.5 mm.

I am not aware of the differences existing between *joiceyi* and *sericeipennis javanica,* described also by Clark (l.c. 12, 1930, p. 26 - 27) after a ♂ from Mt.

Gedeh (W. Java). The description of this new subspecies is very vague and gives no decisive answer about its relationship to *joiceyi*.

O. sericeipennis joiceyi is here recorded from Java for the first time.

10. **Marumba spectabilis** (BTLR.), **subspec.**

1 ♀, dated February, 1915.

(1 ♂, Mt. Panggerango-Gedeh, southern slope, Perbawatie Est., 1000 m, Dec. 1936, M. E. WALSH).

Not yet reported from Java.

♀ Pasir Datar. — A single specimen of this very rare species in excellent condition.

Apparently almost identical in colouring to the type described from Darjeeling (Sikkim). Here follows a short description (cf. ROTHSCHILD & JORDAN, Revision, 1903, p. 273 - 274):

The underside of the fore wing has an apical patch of the same bright orange-tawny colour as the anal area, but this tint is restricted to the apex between SC_4 and SC_5; the rest of the wing-tips is Verona-brown, bordered by a convex line that runs from the costal margin to the tip of R_3; first discal line several mm proximal to base of SC_5 (placed under right angles at base of R_1!); fifth line ceasing at R_3, thence interrupted, marginally less distinctly continued to tip of M_1. First line of hind wing close to base of fork M_1 - M_2 and continued in cell; fourth line strongly angulate at M_1, 4 mm distant from tip of M_1.

Vaginal plate exactly identical in shape to that of typical *spectabilis*, figured by Dr. JORDAN (Revision, pl. XIX, fig. 2).

Fore wing 54 mm.

♂ Perbawatie. — The locality is only few miles distant from Pasir Datar. Markings as in the ♀ described above. Colouring of upperside of wings a little darker. The tenth tergite is deeply divided and the lobes are decidedly broader than in typical *spectabilis*: parallel-sided and broadly rounded apically (not notched as in *spect. malayana* R. & J., nor obliquely rounded as in typical specimens!); sternite produced on middle to form a low rounded lobe (cf. R. & J., Revision, pl. XXVI, fig. 1).

Fore wing 47.5 mm.

As appears from the description, these Javan examples agree in most respects with Indian *spectabilis*. The form of the tenth sternite of both sexes suggests a closer affinity to the typical race than to the subspecies *malayana* R. & J., described from Benkoelen (S. Sumatra). Very likely the Javan insect represents a distinct subspecies but more material is needed to settle this point.

Subfam. PHILAMPELINAE.

11. **Chromis erotus erotus** (CR.).

1 ♂, dated February, 1915.

12. **Deilephila hypothous** (CR.).

1 ♂, 4 ♀, two of these dated February, 1915.

These individuals are quite similar to specimens from the environs of Buitenzorg.

13. **Elibia dolichus** (WESTW.).

1 ♂, Pasir Datar, Nov. 1935, M. BARTELS Jr.

Not different from Buitenzorg specimens, dark stripes sharply pronounced.

14. **Acosmeryx socrates cinerea** BTLR.

3 ♂, 1 ♀, the latter dated February, 1915.

A fine series, not differing from a ♀ in the Buitenzorg Museum from Loeboek Sikaping (W. Sumatra).

15. **Panacra mydon elegantulus** (HERR.-SCH.).

2 ♂, one labelled February, 1915.

16. **Panacra dohertyi** ROTHSCH.

1 ♂, dated February, 1915.

Not previously recorded from Java. Referred by me to *dohertyi* with some misgivings, but definitely recognized as that species by Dr. JORDAN to whom the specimen was sent for examination. The typical race of this species is known from Perak, Sarawak (Borneo) and the island of Nias. It was recently reported from N.E. Sumatra by ROEPKE (Misc. Zool. Sum. 99, 1935, p. 6). A race from Assam has been characterized by GEHLEN as *doh. continentalis* (Int. Ent. Zeitschr. Guben, 24, 1930, p. 218).

JORDAN gives 76.5 mm for the wing-expanse of the type but this is possibly an error for ROEPKE's ♀ measured only 59 mm and our Javan example 60 mm (fore wing 27.5 mm).

17. **Angonyx testacea** (WLK.).

1 ♀, dated February, 1915.

18. **Enpinanga borneensis** (BTLR.).

1 ♂.

New to Java. It has been a matter of some difficulty to correctly identify this delicate little species inasmuch as the available descriptions of the three allied species *assamensis, borneensis* and *labuana* are not at all detailed and at the same time may give rise to some confusion.

The ♂ and ♀ from W. Java have been examined by Dr. JORDAN who tells me in a letter that there is no difference between these specimens and those which are in the Tring Museum from Borneo.

ROTHSCHILD & JORDAN (Revision, p. 546) state that there are no pale postdiscal patches on the underside of fore wing but this is evidently a *lapsus calami.* On comparing *borneensis* with *assamensis,* SEITZ follows these authors and writes on it: "Vorderflügel unterseits gleichfalls ohne lehmgelben Fleck".

Apart from the above mentioned ♂, the Buitenzorg Museum possesses one ♂ and one ♀ of *borneensis* from the following localities:

1 ♂ W. Billiton I., Tandjong Pandan, sea-level, Dec. 31, 1936, F. J. KUIPER leg.;

1 ♀ W. Java, Buitenzorg, 250 m alt., "at lamp", Jan. 9, 1933, M. A. LIEFTINCK leg.

These three specimens agree perfectly with one another and correspond rather closely with the coloured drawing in SEITZ (pl. 64d). *E. borneensis* may be characterized as follows:

♂♀ Upperside. — Fore wing: smoky drab-gray, or smoky-gray at certain lights, with silvery hue. Two large, angular patches, deep velvet-black in colour, on middle of anterior portion of wing, the external costal patch largest, cut off along R_2, and two rather well defined, somewhat Z-shaped or crescentic, creamy-yellow postdiscal (prae-apical) spots R_3 - M_1 and M_2 - SM_2, the latter about 2 mm distant from the anal angle and black-bordered externally. A minute black point upon SC_4 close to base.

Hind wing: Hay's or Natal brown with slight marginal silver-white scaling between ends of M_1 - M_2 and M_2 - SM_2; area posterior to SM_2 creamy-yellow upwards to base of wing.

♂♀ Underside. — Fore wing: pale cinnamon-buff (♂ Java, discoloured), cinnamon-drab (♀ Java), or vinaceous-pink (♂ Billiton), except a broad, irregular marginal band which is drab-coloured. No dark patches on middle of anterior portion of wing but an indistinct, cloudy, grey-brown costal spot extending across the wing from end of SC_2 to R_1. An undulated brown line from near apex (end of SC_3) inward to R_2 (similar to upperside) but joined interiorly by a ferruginous stripe. Crescent- or Z-shaped creamy yellow spot R_3 - M_1 and M_2 - SM_2 as on upperside of wing but definitely better pronounced exteriorly.

Hind wing: slightly paler and more vividly coloured than fore wing; disc in the ♂ of Billiton more definitely pinkish; a transverse, postmedian row of brownish speckles upon the veins (this row parallel to distal border), and a brown costal spot on middle of wing. Area posterior to SM_1 a little paler. Small and indistinct creamy-yellow postmarginal spots between M_2 - SM_2.

Sexes very similar. Fore wing ♂ 24, ♀ 25 mm.

Subfam. CHAEROCAMPINAE.

19. **Hippotion echeclus** (BSD.).
2 spec.

20. **Hippotion rafflesi** (BTLR.).
2 spec., one dated February, 1915.

21. **Hippotion boerhaviae** (F.).
2 spec., one dated February, 1915.

22. **Hippotion celerio** (L.).
1 ♂, dated February, 1915.

23. **Theretra alecto** (L.).
1 ♂, 1 ♀.

24. **Theretra clotho** (DR.).
1 ♂, dated February, 1915.

25. **Theretra latreillei lucasii** WLK.
1 ♀, dated February, 1915.
(I took this species at Tjisaroea, on the opposite (northern) slope of Mt. Panggerango, about the same altitude).

26. **Theretra oldenlandiae** (F.).
1 ♀, dated February, 1915.

27. **Theretra rhesus javanica** ROTHSCH.
1 ♂, 1 ♀, February, 1915.
Theretra javanica was described by ROTHSCHILD in Novit. Zool. 1, 1894, p. 76 after a single specimen from 'Java'. The colouring of the body of the type was described as deep grey above, the abdomen with deep brown dorsal longitudinal stripes. In our ♀ the thorax as well as the abdominal stripes are distinctly olive-green, the lateral dark patch to the basal segments being dark brown. In the ♂ the third (narrowest) transverse olive-green stripe on the fore wing is so much effaced as to be scarcely perceivable. Fore wing ♂ 43, of ♀ 42 mm.

On account of the presence of the black basi-lateral patch to the abdomen (which is not mentioned in the original description) I thought that this insect might belong to a species allied to but distinct from *rhesus*, but Dr. JORDAN, having confronted it with *javanica*, is of opinion that the latter is a subspecies of *rhesus*.

28. **Theretra nessus** (DR.).
8 ♂, one of these dated February, 1915.
Apparently quite common at Pasir Datar.

29. **Rhyncholaba acteus** (CR.).
3 ♂, 1 ♀, one labelled February, 1915.

30. **Rhagastis castor** (WLK.).
1 ♂.
Evidently a rare species.

31. **Cechenena pollux** (BSD.).
1 ♂.
(1 ♂, Mt. Gedeh, northeastern slope, Tjibodas, 1400 m alt., leg. H. H. KARNY, Mus. Buitenzorg).

The ♂ from Tjibodas has the body and fore wings green above, as in typical examples (SEITZ, pl. 68b), the terminal abdominal segments showing a scattered cinnamon scaling on the mesial parts, between the two pale yellow lines. The specimen is not in too good a condition, but 4 of the normally 5 straight lines on the upperside of the fore wing are well visible. Fore wing 46 mm.

Our second specimen, from Pasir Datar, differs considerably from the first in that the colouring of the upperside of the thorax and abdomen is bright ochraceous-orange, the fore wings being more ochraceous-tawny with cinnamon-brown stripes. These stripes are less distinct than usual, only the first and third (this extending from wing apex to the median point of inner margin) being conspicuous.

As regards colours this specimen seems to resemble *C. pollux* ab. *rubrescens* CLARK, described from Mt. Korintji (S.W. Sumatra), in which the normal green tint is replaced throughout by reddish-brown, but at the same time it is stated that there is greater contrast in colour between the transverse lines of the fore wing above and the remainder of the wing, a condition not shared by our Javan specimen (cf. CLARK, Proc. New Engl. Zoöl. Club, 8, 1923, p. 74).

According to ROTHSCHILD & JORDAN (Revision, p. 803, 804), the body-colour in at least some of the species of *Cechenena* varies from green to reddish-brown. Fore wing 50 mm.

32 **Cechenena lineosa subangustata** ROTHSCH.

1 ♂, dated February, 1915.

A prominently striped specimen. Resembling the coloured drawing in SEITZ (pl. 68a), of typical *lineosa*, but body ochraceous-tawny instead of green and anterior third of fore wing likewise similar in colour to the remainder of the wing (not green). Basal black patch on upperside of hind wing less deepened, extending further distad anteriorly, its distal margin very diffusely limited, running parallel to the distal margin of the wing and lacking the black rays upon the veins. Accordingly, the pale band evenly narrowed anterad, not reaching costal margin of wing. The three proximal stripes of fore wing quite distinct. Fore wing 56 mm.

This species is new to the Javan fauna.

A NEW RAT FROM JAVA.

By

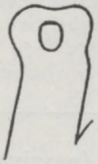
M. BARTELS, Jr.

(Soekaboemi, Java).

Rattus canus sodyi, subsp. n.

Type: — Adult female (skin and skull), coll. M. BARTELS Jr. no. 580, S.W. slopes of Mts Pangrango-Gede (W. Java), 1000 m, Oct. 18th, 1933, Author leg. Paratype female (no. 1080) and do male (no. 1269) in the Buitenzorg Museum collection.

Diagnosis: — Size about equal to that of *R. canus malaisia* KLOSS [1]) from the Malay Peninsula (which is much smaller than typical *canus* (MILLER)). Differs from *R. c. malaisia* by the following characters: hindfoot larger; nail of the hallux still more reduced, very short and flat; tail much longer, *unicolourous;* naked area on belly absent; fur longer; upperparts less greyish, the grey rather strongly intermingled with yellowish; alatal foramina larger and reaching farther backwards; bullae larger and much more inflated.



Right hallux of *Rattus canus sodyi* subsp. n. × 3.

Fur: — Fairly soft and dense. Above composed of three elements: *a*) soft hairs, *b*) a certain number of slender spines and *c*) long hair-bristles, the latter being longest and most numerous on the back and hind-back.

Colour: — Base of the pelage dark ashy on the back, becoming lighter towards the sides, distal ends of the hairs yellowish, the general colour impression of the upperparts thus produced being a mingling of grey and yellowish. Spines whitish with blackish brown tips, hair-bristles blackish brown throughout on the back, many of them tipped with whitish and showing light bases on the flanks. General colour of flanks and sides of limbs distinctly paler than the back, more greyish. A narrow ring around the eye blackish brown. Undersurface pure chalk-white, sharply margined, hairs white throughout. The white of the underparts separated from the feet and the base of the tail by a dark ashy band. Hands and feet clad with greyish brown and whitish hairs, the latter principally on the outer sides; the nails, except that of the hallux, overhung by long silvery white hairs. Tail dark greyish brown throughout.

Ringing of the tail: — 9 to the centimetre in the middle.

Mammular formula: — 2 + 2 = 8.

[1]) To the kindness of Mr. F. N. CHASEN of the Raffles Museum, Singapore, who was the first to recognize the close relationship of our new rat to *R. c. malaisia,* we owe the opportunity of examining a specimen of the latter form.

Measurements and weight: — The measurements (in mm) of 9 adult specimens and the weight (in g) of 5 specimens are given below [1]).

No. Coll. M. BARTELS Jr.	Sex	Head and body	Tail	Ear	Hindfoot	Skull							Weight	Remarks
						Greatest length	Basal length	Zygomatic breadth	Median length nasals	Greatest breadth combined nasals	Palatal foramina	Upper molar row		
580	♀	189	260.5	23	37.5	43.8	39.9	22.5	14.6	4 6	8.7	8	188	Mamm. much devel. *Type*
597	♂	178	271	21.5	38	42.7	38.7	20.9	14.2	4.7	8.1	7.8	175	Test. 17 mm
1080	♀	190	262.5	22 5	39	44.4	41.7	22.5	15.2	4 6	8.1	7.6	—	Mamm. devel.
1269	♂	182	279	22	39	43.5	39.4	21.3	14.7	4.7	7.9	7.9	176	Test. 19.5 mm
1333	♂	182	285.5	22	39.5	42.9	38.6	20.4	14.3	4.4	8,2	7.7	—	Test. 21.5 mm
1339	♂	209.5	305	24 5	43.5	46.9	43.4	22.9	16.4	4.8	9.3	8.5	230	Test. 24 mm Teeth worn
1341	♀	190 5	286	22.5	39.5	44.8	41.2	22.2	14.9	4 8	8.5	7.9	204	Mamm. much devel. Teeth slightly worn
1786	♂	191	269.5	23	40	44.2	39.8	21.8	14.2	4.4	8 5	8.1	—	Test. large
1787	♂	205.5	290.5	23.5	41.5	45.7	41.9	21.8	15.6	4.7	8.1	7.9	—	Test. large

(The measurements of the type of *R. c. malaisia,* an adult male (as given by KLOSS in Bull. Raffles Mus., 5, 1931, p. 107), are: Head and body 190; tail 215; ear 24; hindfoot 35; skull, greatest length 43.9; basal length 39.2; zygom. breadth 23.5; med. length of nasals 15; greatest breadth comb. nasals 5.9; palat. foram. 6; upper mol. row 8.1 mm).

Specimens examined: — 17 (ad. and juv.), all from the type-locality.

Habits: — The majority of the specimens was caught from dead and more or less decaying big bamboo-stems in the forest, into which the rats had gnawed little entrance-holes measuring about 3 - 4 cm in diametre. Such holes had also been gnawed in the partitions between the internodia. A nest made of dry leaves etc. containing four young rats was found in such a situation on January 24th, 1935. The peculiar hallux and short foot showing well-developped pads probably indicate arboreal or semi-arboreal habits.

Name: — I have the pleasure of naming this new form, which constitutes an interesting new addition to the Javan mammalian fauna, after Mr. H. J. V. SODY, who has so largely contributed to our present knowledge of the Javan *Muridae.*

[1]) No. 1786 was measured after having been preserved in alcohol; all the others were measured in a fresh state. The head-and-body-length was measured from the tip of the nose to the hind-border of the thigh-muscles at the base of the tail.

NON MARINE MOLLUSCA OF ENGGANO ISLAND.

By

TERA VAN BENTHEM JUTTING

(Zoological Museum, Amsterdam).

The island of Enggano is the largest of a group of 7 small islands lying in the Indian Ocean at about 100 geographical miles off the SW point of Sumatra, between 102° 7′ and 102° 23′ E, and 5° 18′ and 5° 30′ S. (HELFRICH, Tijdschr. Aardr. Gen. (2) Vol. 5, 1888, p. 272 - 314 and OUDEMANS, ibid. (2) Vol. 6, 1889, p. 109 - 164).

The first non marine mollusc ever described from Enggano was *Amphidromus enganoensis* by FULTON in 1896 (1). Two years later J. B. HENDERSON Jr. when reporting on the collection made by WILLIAM DOHERTY in the island, arrived at a total of 21 species (2). After this SYKES (3) and FRUHSTORFER (5) published a few additions, while ANCEY (4) introduced a new name, *Macrochlamys hendersoni,* to replace *Macrochlamys dohertyi* HENDERSON, the latter being preoccupied.

In 1936, from the end of May till the beginning of July, Enggano was visited by a party of Dutch scientists for botanical and zoological collecting purposes. The zoologist of the expedition, Dr. J. K. DE JONG, succeeded in obtaining 14 species of land and fresh water snails from three different localities, viz. Boeah-Boeah, Meok and Kajaäpoe. The exact situation of these collecting places is indicated on the accompanying sketch-map.

The samples were delivered to the Zoological Museum at Buitenzorg (Java) whence they were transmitted to me for identification and reporting. At the same time I could include in my account two sets of Enggano shells collected by the late Major P. A. OUWENS in previous years. The material I had before me is preserved in the Zoological Museum at Amsterdam. Duplicates are placed in the Zoological Museum at Buitenzorg.

In the following survey I give a list of all the non marine molluscs known from Enggano up till the present day. The species collected by Dr. DE JONG and Major OUWENS are printed in heavy type. The species not secured by these gentlemen, but recorded in literature cnly are printed in italics.

Neritina subsulcata Sow. — Boeah-Boeah, 11 spec. New record for Enggano.
Neritina variegata LESSON — Boeah-Boeah, 7 spec. New record for Enggano.
Neritina cornea L. — (HENDERSON, p. 15).
Neritina turrita CHEMN. — (HENDERSON, p. 15).
Neritina ziczac LAM. — (HENDERSON, p. 15).
Septaria suborbicularis Sow. — Meok, 1 spec. New record for Enggano.
Helicina spec. indet. — (HENDERSON, p. 17).

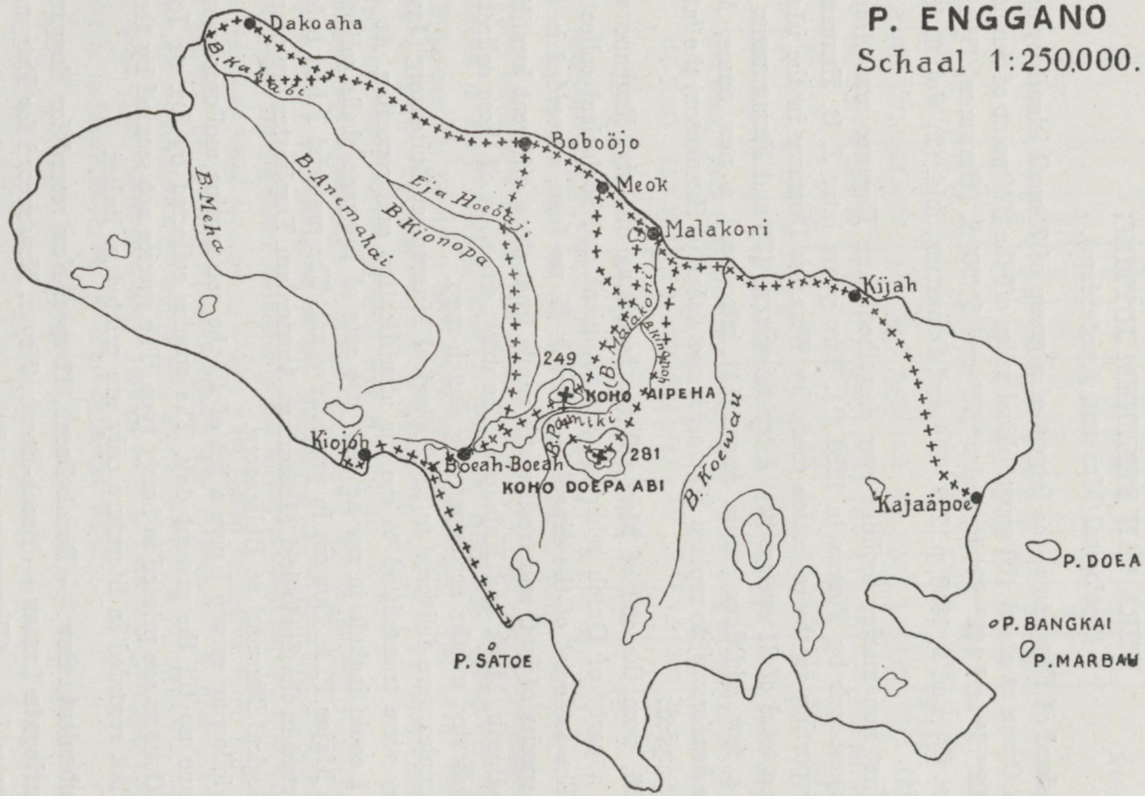


Fig. 1. Sketch-map of Enggano Id. ++++++ = foot-paths.

Leptopoma vitreum Lesson — Boeah-Boeah, 3 spec. (also Henderson, p. 17).

Japonia cilifera (Mouss.) — (Henderson, p. 17).

Crossopoma enganoense Henderson — Boeah-Boeah, 1 spec.; Meok, 1 spec. (also Henderson, p. 17).

Truncatella ceylonica Pfr. — (Henderson, p. 17).

Thiara badia (Henderson) — Boeah-Boeah, 45 spec. (also Henderson, p. 14). The species is very much related to *Thiara sobria* (Lea) and might perhaps prove to be identical with it.

Thiara scabra (Müll.) — Boeah-Boeah, 34 spec. New record for Enggano.

Thiara tuberculata (Müll.) — Boeah-Boeah, 5 spec. New record for Enggano.

Thiara spec. juv. — Meok, 3 spec. Very young and slender shells.

Thiara hastula (Lea) — (Henderson, p. 15).

Thiara herculea (Gould) — (Henderson, p. 14).

Cassidula mustellina Desh. — (Henderson, p. 15).

Melampus fasciatus Desh. — (Henderson, p. 15).

Pythia pantherina (A. Ads.) — Meok, 14 spec. New record for Enggano.

Pythia striata Reeve — (Henderson, p. 15).

Trochomorpha dautzenbergi Sykes — Meok, 4 spec. (also Sykes, p. 87).

Trochomorpha gulielmi Sykes — Boeah-Boeah, 7 spec.; Meok, 1 spec.; Enggano (Ouwens) 5 spec. (also Sykes, p. 87).

Trochomorpha hartmanni (Pfr.) — (Henderson, p. 15).

Trochomorpha hartmanni is a species from Morotai Id., north of Halmahera (Moluccas). In his "Ostasiatische Landschnecken", von Martens (1867, p. 248) doubted already the locality Java which was mentioned by Reeve (Conch. Icon. Vol. VII, 1852, no. 489). Henderson's specimens should probably be united with one of the preceding species of Sykes. Without having seen the shells it is difficult to decide with which of the two it is identical, the two species differing only in minor details.

Macrochlamys hendersoni Ancey — (Henderson, p. 16, s.n. *Macrochlamys dohertyi;* Ancey, p. 320).

Helicarion lineolatus Martens — Boeah-Boeah, 3 spec. New record for Enggano.

Helicarion albellus Martens — (Henderson, p. 16). Henderson is not quite sure of his identification, and mentions the comparatively short spire of his specimen(s). Could he have had shell(s) of the preceding species before him?

Glessula spec. indet. — (Henderson, p. 16).

Prosopeas argentea Henderson — (Henderson, p. 16).

Planispira aldrichi Henderson — Boeah-Boeah, 7 spec. (also Henderson, p. 15). In the original description the dimensions are running: alt. 15, greater diam. 28, lesser diam. 23 mm. The adult shells collected at Boeah-Boeah are measuring:

height	16,	max. diam.	29,	min. diam.	25 mm.
„	12,	„	26,	„	22 „
„	11,	„	24,	„	20 „
„	11,	„	23,	„	19 „

The 3 others are immature and have not been measured. It is remarkable that even those full grown shells are so diverging in capacity.

Amphidromus enganoensis FULTON — Enggano (OUWENS) 8 spec.; Kajaäpoe, 16 spec.; Boeah-Boeah, 25 spec. (also FULTON, p. 71 and HENDERSON, p. 15). In the latter set 9 shells are approaching the forma *sykesi* as proposed by FRUHSTORFER (p. 200). FULTON described and figured only the sinistral form, but in my samples both sinistral and dextral shells occur, the latter in a minority. The three sets are analysed hereafter according to age and colour and according to left- or right-handed condition of the spiral.

Enggano 8 adults, all uniformous rich brown, 6 sinistral, 2 dextral.

Kajaäpoe 8 adults, 8 juv., all uniformous yellow, all sinistral.

Boeah-Boeah { 20 adults, 5 juv. (total)
13 ad. 3 juv. yellow to rich brown (colours merging into each other), 11 sinistral, 5 dextral
7 ad. 2 juv. forma *sykesi*, 8 sinistral, 1 dextral.

From the little island Poeloe Doea, lying in the Enggano group, FRUHSTORFER (p. 200) described a small form of *Amphidromus enganoensis* to which he gave the subspecific name *gracilior*.

By the preceding list we arrive at a total of 31 species of non marine mollusca occurring in Enggano. Of this number 3 are not identified specifically and one is probably wrongly named (*Trochomorpha hartmanni*). Substracting these 4 there remain 27 species which can serve for a zoogeographical analysis.

The most interesting species are the endemics of which Enggano contains 8 (*Crossopoma enganoense, Thiara badia, Trochomorpha dautzenbergi, Tr. gulielmi, Macrochlamys hendersoni, Prosopeas argentea, Planispira aldrichi* and *Amphidromus enganoensis*). Of the remaining 19 there are 16 common inhabitants of a great many islands in the Malay Archipelago (the *Neritina*'s, *Septaria suborbicularis, Leptopoma vitreum, Truncatella ceylonica, Thiara scabra, tuberculata, hastula* and *herculea, Cassidula mustellina, Melampus fasciatus, Pythia pantherina* and *striata*). The last three (*Japonia cilifera, Helicarion lineolatus* and *albellus*) are recorded from both Java and Sumatra and point to a previous connection with at least one of these islands.

LITERATURE

1. 1896 FULTON, Ann. Mag. Nat. Hist. (6) Vol. 17, p. 66-94.
2. 1898 HENDERSON, The Nautilus, Vol. 12, p. 13-17.
3. 1904 SYKES, Journ. Malac. Vol. 11, p. 87-92.
4. 1905 ANCEY, Journ. de Conch. Vol. 53, p. 310-327.
5. 1905 FRUHSTORFER, Nachr. Blatt, Vol. 37, p. 198-201.

ON A METHOD FOR CATCHING PLANCTON IN DIFFERENT DEPTHS

by

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When some time ago (in 1936) Dr. C. HOLSTVOOGD [1]) studied the development of the kidneys in the larvae of several fishes, it proved necessary to dissect the youngest stages of the rather primitive *Chanos chanos* (FORSK.), the so-called milk-fish, or as it is called by the natives, the i k a n b a n d e n g. This fish is reared in big quantities in salt-water ponds along long stretches of the north-coast of Java. However easily the i k a n b a n d e n g may be reared in these ponds, yet it never attains maturity there and again and again the ponds have to be stocked with fresh fry. The young fry, which is caught in the sea quite near the shore with small dip-nets, is quite transparent, ribbon-shaped and has a length of about 13 mm (C.f. DELSMAN, Treubia XI, 1929, p. 285). Young fry of this length is found in millions every year along the north coast of Java. About the younger stages, however, we do not know very much and DELSMAN, formerly Head of the Laboratory for Investigation of the Sea, in his year-long investigations about the planctonic eggs and larvae of the Indo-Australian Seas got only a few single specimens. I thought it evident therefore, as DELSMAN found them only very rarely in his surface hauls, that these young larvae lived in deeper regions, perhaps even near the sea-bottom.

To get these young specimens proved to be not an easy task, as a regular towing with a planctonnet along the sea-bottom is impossible and the same can be said of bringing up bottomwater in such large quantities that there would be any chance that it should contain bandenglarvae! Some other method had to be planned therefore and so Dr. HOLSTVOOGD suggested to catch the larvae with a planctonnet in the form of an ordinary fishtrap. The instrument was laid out in water with a depth of about 9 - 10 meters and a few larvae were captured indeed. They proved however to be of about the same stage as the larvae caught by the natives at the surface. The results as regard to the bandenglarvae were therefore rather poor as the expected younger stages were not captured, which however may have been incidental. Future investigations will have to make this out. The net however proved to be an excellent instrument to catch plancton.

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[1]) C. HOLSTVOOGD "The Development of the Mesonephros in some Teleosts" Dissertation University of Amsterdam 1936.

The outlines of this trap are given in figure 1. The sides consist of plancton-gauze. The length of our model is about 95 cm, the width of the greatest diameter at the frontend is about 35 cm and the diameter at the other side is about 10 cm. The diameter of the opening which gives admission to the interior of the trap is about 8 cm. Of course none of these measurements are essential. They can be altered at will as is the case with the number of the planctongauze. At the end of the planctontrap a bag of planctongauze is sewn on loosely so that it can be removed easily. The bottomend of the bag is closed with a cord so that the contents may be taken away in an easy manner.

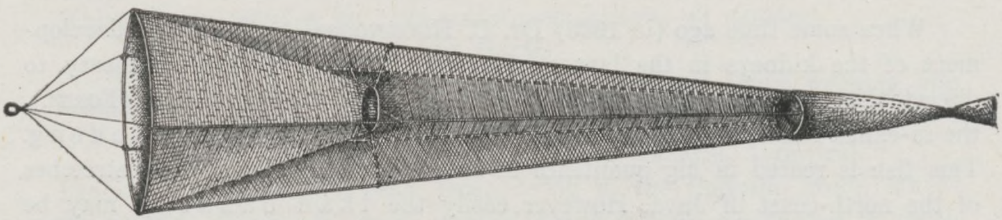

Fig. 1. Sketch of the plancton-trap. The frame is made of ironwire.

It will be obvious that this planctontrap can be used at any depth and at almost any place. It is attached to a long rope which has to be somewhat longer as the depth at the particular place where it is going to be used. The rope is held in position by a small anchor. At the other end a float of some material is fastened. The planctontrap can be attached at any length of the rope and will be held in a more or less horizontal position by the tide. Eventually, if there is only very little tide and therefore a very slow and feeble current, a small float at the end of the trap may be fastened in order to maintain it more or less horizontal. If the tide should be very strong I should advise to attach to the big driver at the surface a second rope with a second float, as it may happen that the whole is pulled down by the force of the current. The second driver will prevent this.

The whole apparatus can be left alone now for some time. How much water will be filtered through the planctontrap in a given time will depend of course on the strength of the current. How long the trap will be left fishing must depend entirely on local circumstances. Here in the Bay of Batavia for instance a period of five or six hours is already rather long as the bag is so filled then with diatoms, that it is difficult to distinguish other things in the catch. Farther out in the sea however this time can be prolonged longer without any difficulty. Changing of the tide is often followed by an alteration in the direction of the current. This will have no effect at all on the capacity of the trap as this will turn with the alterating current.

The advantage of the described method is in the first place that we are able now to take plancton just above the sea-bottom with a very cheap

and handy apparatus. Should we attach more traps to the rope at different depths (See fig. 2) then we shall be able to examine the quality (the composition) of the plancton at each desired depth. The quantitative results are not quite reliable of course, as the strength of the current is not the same in different depths. A second advantage I see in the fact that during the time that the apparatus is fishing the ship can be used for other purposes as the whole gear can be abandoned temporarily. After returning the traps can be lifted and, if desired, be put out again. In this way the diurnal migrations of certain organisms may be studied. A disadvantage is found in the fact that the gear can not be closed while it is being lifted which however it has in common with all non closing townets. The catch taken during the hauling up will be almost negligible when the actual fishing time in the horizontal position has been long enough.

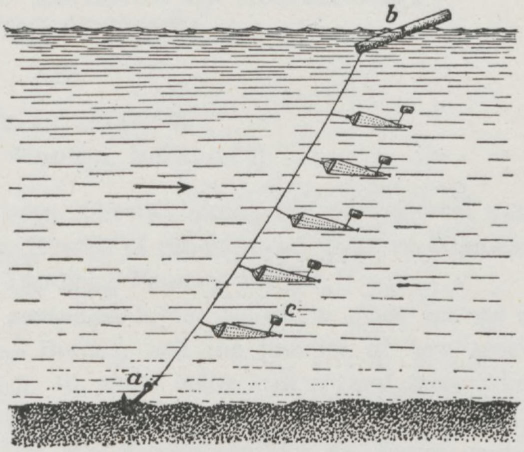

Fig. 1. The whole apparatus. a, anchor. b, float to which may be attached a second rope with a second float, to prevent drowing of the gear when the current is too strong. c small float attached to the trap. The arrow indicates the direction of the current.

DESCRIPTIONS AND RECORDS OF SOUTH-EAST ASIATIC ODONATA.

By

M. A. LIEFTINCK
(Zoölogisch Museum, Buitenzorg).

Material for this paper has been collected during the past several years chiefly by Messrs. L. COOMANS DE RUITER of Singkawang, Western Residency of Borneo, and F. J. KUIPER, of Tandjong Pandan, Billiton.

There are about 130 species contained in the collection made for me by Mr. COOMANS DE RUITER in West Borneo, and the number of new species discovered by him is now raised to 16, there being still several more which require further examination and study.

The Billiton collection made by Mr. KUIPER contains 86 species, and of the 9 novelties 6 are here described as new (3 of these occur also in Borneo).

Full lists of these two exceedingly interesting collections will, it is hoped, be published separately as soon as the last difficulties in identifying them have been surmounted.

Other material of the greatest interest was borrowed for study from the University Museum of Michigan, Ann Arbor, through the good offices of Mrs. LEONORA K. GLOYD. From her I obtained a great many Asiatic Odonata, chiefly from the Malay Archipelago, which form part of the FÖRSTER and WILLIAMSON collections.

In other cases assistance is noticed when treating of the species, in connexion with which such assistance was rendered.

SYSTEMATIC.

Fam. LIBELLAGINIDAE.

Libellago dorsocyana, sp. n.	Borneo.
—— *aurantiaca* (SELYS).	Sumatra, &c.
—— *stigmatizans* (SELYS).	Malaya, Sumatra.

Fam. LESTIDAE.

Lestes praecellens, sp. n.	Java.
—— *praemorsa* SELYS.	Notes on characters and distribution.

Fam. PLATYSTICTIDAE.

Drepanosticta sharpi (LAIDLAW).	Malaya.
—— *fontinalis*, sp. n.	Malaya.
—— *pytho*, sp. n.	Sumatra.
—— *bartelsi*, sp. n.	Java.
—— *ephippiata*, sp. n.	Celebes.

Fam. PROTONEURIDAE.

Elattoneura analis (SELYS).	Malaya, Borneo.
—— *longispina,* sp. n.	Billiton, Borneo.
—— *coomansi,* sp. n.	Banka, Billiton, Borneo.
—— *aurantiaca* (SELYS).	Sumatra, Banka, Billiton, Borneo.
Prodasineura tenebricosa, sp. n.	Borneo.
—— *haematosoma,* sp. n.	Borneo.

Fam. AGRIONIDAE.

Pseudagrion coomansi, sp. n.	Banka, Billiton, Borneo.
—— *celebense,* sp. n.	Celebes, Halmahera.
—— *papuense* (TILLYARD).	Australia (Queensland).
—— *perfuscatum,* sp. n.	Borneo.
Teinobasis leonorae, sp. n.	Malaya.
Amphicnemis kuiperi, sp.n.	Billiton.
Mortonagrion appendiculatum, sp. n.	Billiton.

(With new localities for the known species).

Fam. LIBELLULIDAE.

Brachygonia puella, sp. n.	Billiton.

Fam. CORDULIIDAE.

Hemicordulia magica, sp. n.	Bali.

Fam. GOMPHIDAE.

Onychogomphus rappardi, sp. n.	Sumatra.
—— *naninus* (FÖRSTER).	Tonkin.
—— *aemulus,* sp. n.	Sumatra.

Fam. LIBELLAGINIDAE.

Libellago dorsocyana, sp. n. (fig. 1).

Material studied: — S. Borneo, 1 ♂ (ad.), Afd. Sampit, Kota Waringin River, Riamtiwata, Dec. 1935, J. J. MENDEN leg. The specimen is the holotype.

Male. — Labium and mouth-parts shiny black, base of middle- and side-lobes of labium yellow. Labrum and base of mandibles shiny black, the former with very slight purplish reflex. A vertical yellow spot on the genae. The convex anterior part of the clypeus (anteclypeus) transversely rugose, brilliant metallic-violet, indistinctly yellowish at extreme base; the flattened dorsal surface also rugose, brilliant metallic-green; posterior surface black, unmarked. Dorsal surface of head velvet-black; a point on either side of the posterior ocelli, the occipital plate, and a round spot at each end of it upon the postocular lobes, clear yellow. Antennae black. Rear of the head deep black.

Prothorax black, spotted with bright yellow, as follows: — a diamond-shaped median streak along anterior lobe; a large, rather lozenge-shaped spot upon the middle of the swollen posterior division of the prothorax and two

slightly smaller spots of the same colour along the sides: one about middle and a second just before posterior margin; finally, a tiny comma-shaped yellow line along posterior margin between the mid-dorsal and lateral yellow spots.

Synthorax dead black, marked with bright greenish-yellow as shown in fig. 1. Mesothoracic triangle short, black; median carina finely yellow; antehumeral stripes situated very near to the humeral suture, incomplete, widest below and tapering dorsally. Ante-alar triangles each with a triangular yellow spot. Dorsal ends of antehumeral lines indicated by isolated yellow points. Metepisternal and metepimeral bands obliterated, the former divided up and consisting of two angular patches, the lower one (nearest to the spiracle) largest. Ventral surface of thorax black.

Legs entirely black; basal fourth of all femora with a fine yellow interior line.

Wings hyaline, bases flavescent to a level between quadrangle and nodus in anterior pair, to the nodus in the posterior pair of wings, the yellow tint very diffuse distally. No pterostigma in front wing but its apex with a sharply defined, non-metallic, brownish-black spot, extending inwards for about 2.3 mm, its limit almost straight from costal margin to the middle of the wing, from which point it curves gently outwards to reach the opposite margin of the wing at the termination of the vein *Ms*. Pterostigma of hind wing normal, black, covering slightly more than two cells; extreme apices smoky.

Fig. 1. *Libellago dorsocyana*, sp. n. ♂. Dorsal view of head and abdomen, and colour-pattern of synthorax.

Abdomen comparatively broad and much flattened dorso-ventrally, widest point (between segm. 3 and 4) 1.8 mm, thence gradually a little narrowed towards apex. Black: segm. 1 with a narrow transverse blue spot on either side of the middle, and with a yellow lateral point. Dorsum of segm. 2 - 7 light sky-blue; each joint has a black intersegmental ring and the blue marks are surrounded by black, as is shown in fig. 1. Mid-dorsal carina well developed on segm. 3 - 8. Segm. 8 - 10 and anal appendages deep black, as is the entire ventral surface of the abdomen.

Length: abd. + app. 13.5, hw. 16, pt. 0.7 mm.

This fine new species may be distinguished from its congeners by the rich blue colouring of the abdomen and by the peculiar side-markings to the thorax.

Libellago aurantiaca (Selys).

Material studied: — S. Sumatra, 1 ♂, Lampoeng Residency, Terbanggi-hilir near Menggala, Aug. 14 - 20, 1936, M. Bartels Jr. leg.; 1 ♂, same region (more southerly), Bergen Estate, 150 m alt., March 28, 1937, J. van der Vecht leg. — Besides these, there are good series of both sexes in the Buitenzorg Museum from West Borneo and Billiton I.

The differences between the males of *L. sumatrana* (SELYS) and *aurantiaca* (SELYS) have been enumerated by H. ALBARDA, who offered coloured drawings to support his views (VETH's Midden Sumatra, 4, 5, 1881, p. 10, pl. III fig. 1 - 3). In the original description of *sumatrana,* the specific value of these characters was called in question by SELYS, who suggested that *sumatrana* should possibly be a local race of *aurantiaca,* from the Malay Peninsula (4e Add. Syn. Calopt. 1879, p. 52 sep.).

Apart from its much smaller size, however, *L. aurantiaca* is easily distinguished from *sumatrana* by the darkly coloured labrum and clypeus, these parts being always bronzy-black in adult specimens. The dorsal surface of the head is marked with 9 isolated light spots, the two largest of these being rather quadrangular in form and green in colour, placed on the frons, and followed immediately behind by two much smaller ones between the antennae; then follow two longitudinal spots, one on each side of the lateral ocelli, and lastly, there are three pale spots along the occipital margin. The head-markings of *L. sumatrana,* on the other hand, differ widely from those of *aurantiaca:* they are much enlarged, most of the frons being orange, while the spots on the vertex are united and rather in the form of a horse-shoe, open posteriorly, around the ocelli.

The colour-pattern of the thorax and abdomen is also different in the two species. The abdomen of *aurantiaca* is of a brick red colour while that of *sumatrana* is orange-red. A further means of distinction is found in the colour of the 10th segment of the abdomen, which is always black above in *sumatrana,* whereas it bears a large brick red dorsal spot in *aurantiaca.*

Recently, SCHMIDT (Arch. Hydrobiol. Suppl. 13, 1934, p. 325 - 326, tfig. 12) has also classified *sumatrana* as a subspecies of *aurantiaca* but I cannot accept this view for not only do these two insects differ widely from each other in a number of apparently quite constant characters but their area of distribution overlaps, at least so in South Sumatra, where they occur in close vicinity, inhabiting the same district.

L. aurantiaca is new to the Sumatran fauna.

The known distribution is as follows:

L. aurantiaca: — Tonkin (sec. MARTIN), Burma (Mergui), Siam, Malay Peninsula, Sumatra, Billiton, Borneo.

L. sumatrana: — Sumatra, Simaloer, Nias, Sipora, West Java.

Libellago stigmatizans (SELYS).

1932. LIEFTINCK, Konowia, 11, p. 2, 9 - 11 (descr. and key) — ♂ Mt. Ophir and Perak.

Further material: — Malay Peninsula, 1 ♂, Kelantan, leg. WATERSTRADT, 1903 vdt., labelled by FÖRSTER *"Micromerus stigmatizans* Selys"; in the Michigan University Museum, Ann Arbor. — S. Sumatra, 3 ♂, Lampoeng Residency, Bergen Estate, 150 m alt., March 28, 1937, J. VAN DER VECHT leg.

Previously only known from the Malay Peninsula, this rare species has

quite unexpectedly turned up in South Sumatra, the area of its distribution now being considerably extended.

Our Sumatran specimens agree in almost every detail with the males from Kelantan and Perak, and with the type from Mt. Ophir in the Brussels Museum, discussed by me in a previous paper.

The colour of the pale spots on the dorsum of segments 1 - 4 or 1 - 5 of abdomen varies from yellowish (type Mt. Ophir) or bright orange-red (Perak) to deep green. In the Kelantan male the dorsal spots of segm. 1 - 2 are green, those on segm. 3 are green basally turning to orange in their distal half, while those on 4 and 5 are orange. Lastly, in our Sumatran individuals the thoracic and abdominal marks are uniform green without orange intermingling. Occasionally, the spots on segment 5 are obsolete or altogether wanting (two males from Sumatra).

This species is easily recognized by the shape of the black apical spot to the front wing and by the presence of a pterostigma; also by the fine red head-markings and the broad green antehumeral bands. The metepisternal green fascia is divided into two parts by a transverse black bar.

Fam. LESTIDAE.

Lestes praecellens, sp. n. (fig. 2 - 3).

Material studied: — S. Java, 4 ♂, 1 ♀ (ad.), Tjidamar, near Tjidaoen, about 100 m alt., forest-pool near Sempoertjondong, Nov. 5 - 8, 1935, M. BARTELS Jr. leg. Holotype ♂ and allotype ♀ Nov. 5, 1935. S.W. Java, 3 ♂, 4 ♀ (1 ♂ ad.), Oedjoeng Genteng Bay, road-side pool near the coast, March 27 - 29, 1937, AUTHOR leg.

Allied to *praemorsa* SELYS.

Male (ad.) — Labium pale yellow. Mandible-bases and genae yellow-green, labrum deep blue. Colour of the face much faded but in the living insect the entire anterior surface of the head, the clypeus excepted, appears to be bluish-green, upwards to a level slightly anterior to the antennae. Clypeus dull brown, the anteclypeus also blue in fresh individuals; frons and vertex dull brown, the latter with very low bronzy reflections. An orangish point on each side against the posterior ocelli. Postocular lobes and occiput matt greenish-bronze, almost black. Behind the eyes a large orange-brown spot, bordered with black along margin of compound eyes. Rear of the head largely black, densely pruinose-blue. First joints of antennae black, the flagellum reddish-brown. Eyes brown, dark olive-blue in living specimens.

Prothorax dark pinkish-brown, densely pruinose-blue, especially along the sides; dorsum with a longitudinal twin-spot and with the middle of the posterior lobe, dull metallic-green. Synthorax isabella-coloured or buffy olive on dorsum, the sides shading into bright honey-ocher to chamois, specially upon the lower (posterior) portion of the metepimerites. Dorsum of thorax (mesepisternites) marked by a pair of dark metallic-green antehumeral stripes (not noticeably

variable in our series of specimens), straight on their inner border and well separated from one another by a distance equal to their own width, deeply crenulate or lobed on their outer border. This band is widest dorsally, with a somewhat quadrate or sub-triangular lobe projecting from its upper end, a much smaller median lobe (with or without irregularly indented lateral border), and a slightly outcurved prolongation at the lower part of the band, which is evenly narrowed ventrally. Median carina unmarked. Mesepimerites marked with three metallic-green dots: one very small one on the upper end of the humeral suture, one much larger and somewhat elongate spot on the middle of the mesepimerum, and a third, rather more rounded one, along lower portion of the humeral suture, opposite the median prolongation of the mesepisternal band. Thoracic sides otherwise unmarked save for two brownish spots, one at lower end of the incomplete first suture, and one at dorsal end of the second suture. *Metepimerum and under surfaces unmarked* (fig. 2). Dorsum of thorax rather obscured in most specimens and very thinly powdered; the entire metepisternum, the infraepisternites, the anterior (upper) portion of metepimerum, and the middle of the ventral surface, coarsely powdered with light blue. In most specimens the lateral bronzy-green marks are much obscured and pruinosed, so that the spots are made out with difficulty. In the living male the entire thorax, including the ventral surface is pruinose blue, except a honey-ocher stripe along latero-ventral margin.

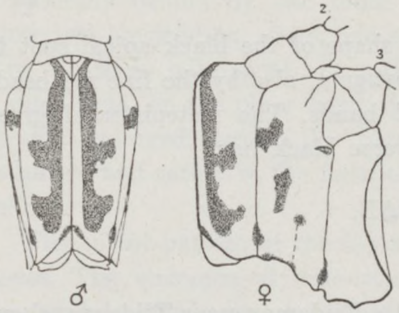

Fig. 2. *Lestes praecellens*, sp. n. Types. Dorsal view of ♂ synthorax and colour-pattern of ♀ synthorax.

Outer surfaces of the pale coxae heavily pruinose. Legs dull yellow-brown; femora with a complete black exterior stripe and a narrow posterior line. Tibiae bright greenish-yellow exteriorly, black interiorly. Tarsi and spines black.

Wings hyaline, or strongly tinted with yellow-brown, except most of the petiole. Pterostigma dark reddish-brown with a fine reddish costal line. Neuration as for genus, very similar to *praemorsa* but wings slightly less abruptly petiolated than in that species and with the pterostigma comparatively longer. Postnodals $\frac{12-14}{11-13}$.

Abdomen marked similarly to *praemorsa;* the dorsal marks dull bronzy-black, those on segm. 2 - 7 not noticeably constricted before the sub-apical expansions, and basal annules also a little smaller than in that species. Sides of segm. 1 - 2 citron-yellow, intermingled with green, light parts of succeeding segments less vividly coloured. Segm. 8 - 10 uniform blackish-brown, lacking distinct pale spots. Basal segments not pruinose but dorsum of segm. 10 powdered with light blue in well-coloured specimens.

Superior anal appendages ochreous, the bases and tips sharply defined black; inferior pair black. Superior pair shaped as in fig. 3. Inferiors broad

and much swollen basally, widely divaricate, the distal third of each suddenly narrowed, forming finger-like appendages, which are directed backwards and provided apically with a bunch of golden yellow hairs; the apices are always invisible in dorsal view but they do not reach beyond the basal tooth-like projection of the superior appendages.

Female (ad.) — Differs from the male only in a few minor respects, especially in the colouring of its body. Mandibles and genae pale brownish-yellow, the latter intermingled with green dorsally. Labrum, clypeus and anterior surface of frons dirty olive, postclypeus and frons indistinctly mottled with brown. Dorsal surface of head as in male; indefinite pale spots are also visible on either side of the occipital crest.

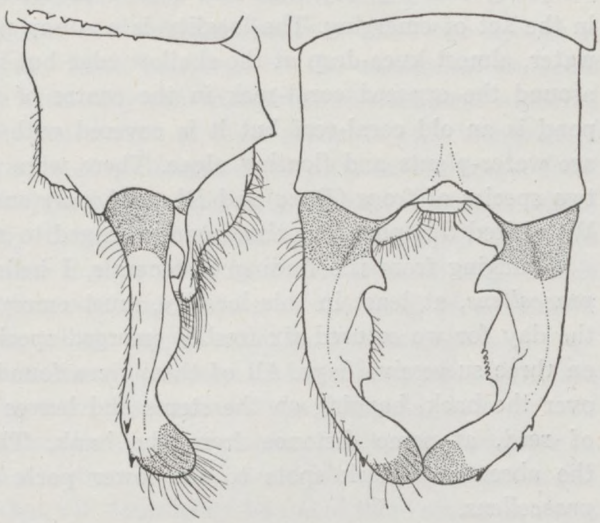

Fig. 3. *Lestes praecellens*, sp. n. Type. Male anal apps., right side and dorsal view.

Pro- and synthorax isabella-coloured, the former very slightly pruinose. Bronzy-green spots on dorsum and sides of thorax very distinct, arranged as in fig. 2. Lower portion of metepisternum (the area around the spiracle) and most of the metepimerites clear olive ocher, *unmarked*. The infraepisternites, a narrow area along lower part of second suture, and the dorsal margin of the metepimerum, pruinose-white, as are the underparts of the thorax and the outer surfaces of the coxae.

Wing-membrane tinged with grey-yellow. Pterostigma light brownish-olive between black nervures; centre isabella-coloured. Postnodals $\frac{13-13}{11-12}$.

Abdomen robust with cylindrical segments. Colouring identical to the male, sides olive-yellow to olive-grey. Dorsal marks not or scarcely constricted before the subterminal expansions. Terminal segments coloured as in male but 8 and 9 have each of them a diffuse, ochreous lateral spot and 10 is apparently wholly light blue above and along the sides, with a fine black line only along posterior border.

Valves black, reddish-brown interiorly, lower margin almost straight (slightly convex on middle in side-view); tips not surpassing end of segm. 10. Anal appendages much depressed, lanceolate, apices pointed; bright yellow, tipped with black.

Length: ♂ abd. + app. 34 - 37, hw. 23 - 24; ♀ 33, 25 mm.

This species was discovered by Mr. BARTELS in 1935 and found back again quite recently about 85 miles towards the west, in apparently rather similar surroundings.

On March 27, 1937, while collecting in the coastal forest along the pathway leading to the cocoa-nut plantation of Tjitespong, near the rest-house of Oedjoeng Genteng, my wife and I took our first specimens of *L. praecellens* in the act of emerging. The locality is a sunny pond-like marsh with stagnant water, almost knee-deep at the shallow edge but increasing perhaps to 2 metres around the exposed coral-rock in the centre of the pool. The bottom of this pond is an old coral-reef but it is covered with soft mud and on the surface are water-plants and floating algae. There were plenty of tadpoles of at least two species of frogs (*Rana* and *Rhacophorus*) and a rich aquatic insect-fauna. We visited this pool four times and managed to secure 36 species of dragonfly.

Judging from the finding of tenerals, I believe that all individuals of *L. praecellens,* at least in this locality, must emerge at about the same hour of the day for we secured six freshly emerged specimens between 9 and 11 *a.m.,* on three successive days. All of them were found with their wings held closed over the back, hanging on the stems and leaves on the sunny side of a bush of reed, at some distance from the bank. These were captured, and, by the absence of dark spots to the lower parts of the thorax, proved to be *praecellens.*

Now it is interesting to note that the same bush of reed yielded several males of *L. praemorsa* as well, but these appeared later on the morning and no tenerals of this species were noticed. Each had its favourite position, hanging on the stems with wings loosely opened and the abdomen held downwards in a S-like curve, a striking attitude peculiar to this species. Though we watched carefully, we found only one place along the pool where the adult of *praecellens* was living. This was on March 29, in the tangly growth of ferns and shrubs overhanging a dark corner of the pool. Although extremely similar to *praemorsa,* it was at once recognized by its slightly larger size, by the unspotted metepimerum and by the less vividly coloured abdomen.

Probably *praecellens,* soon after emergence and on being disturbed, flies into the nearest bush, and its avoiding open water may account for its relative scarceness.

The exuvia being also found, I hope to discuss elsewhere the characters of the larva of *praecellens.*

Lestes praemorsa SELYS.

In the above description of *praecellens,* this new species has repeatedly been compared with *praemorsa* SELYS, on account of its bearing a striking *prima facie* resemblance to that species. Yet it is distinguished at once from *praemorsa* by the absence of black spots on the yellow-coloured metapleurae, the ventral border and the under surfaces of the thorax. This appears to me to be quite

an important specific character to which LAIDLAW [1]) has not called attention in his account of North Indian *L. praemorsa*. In fact, these lateral and ventral points are always present and plainly visible even in heavily pruinosed examples. Recently, E. SCHMIDT has published useful sketches of the thoracic pattern of *praemorsa,* after specimens from N. Sumatra and after the type from Manila (Philippines), and in all these the spots are well shown [2]).

A further very reliable means of distinction between these two species is found in the shape of the bronzy-black markings on the abdominal segments 2 to 7 which, in *praemorsa,* are noticeably constricted before the apical widening of each while in *praecellens* the contraction of these marks is very unapparent. The anal appendages of the male of *praecellens* are different in shape from those of Sumatran and Javan *praemorsa,* especially the inferior pair, which are widely divaricate, abruptly turning into narrow, finger-shaped processes not visible in dorsal view, whereas in *praemorsa* from the Great Soenda Islands they do not so closely fit to the sup. apps., being in the form of pyramidal or bluntly triangular processes, which are directed freely backwards.

L. praemorsa is a very wide-ranging species. I have now seen specimens of a great many localities, viz. from Peninsular India (Nilgiris, 4000 ft. and Coorg, ex coll. FRASER), the Malay Peninsula, Sumatra, Billiton I., Enggano I., W. Java, Kangean I., Palawan, Celebes, Boeroe I., and New Guinea. It has not yet been recorded from Borneo but will doubtlessly be found there sooner or later.

The type is from Manila (cf. SCHMIDT, *antea*), and a short note on the male, also from the Philippines, has been published by RIS after specimens in his own collection (now in the Senckenberg Museum).

Specimens which I have from different parts of the Malay Archipelago resemble each other closely so far as the colour-pattern of the thorax and abdomen is concerned. SELYS and LAIDLAW (loc. cit. *antea*), and more recently SCHMIDT, however, have emphasized the point that the dorsal thoracic marks are individually variable and this is very obviously the case throughout our series of insular specimens.

A number of insular subspecies may ultimately prove distinguishable when the anal appendages of the male, especially that of the Philippines, are studied more closely, for I notice well marked differences in the structure of these organs.

Fam. PLATYSTICTIDAE.

Drepanosticta sharpi (LAIDLAW) (fig. 4, 5a).

1907. FÖRSTER, Fasc. Malay. Zool. 4, p. 10 (sep.) — ♂ Kelantan, leg. WATERSTRADT (*Platysticta quadrata,* partim: FÖRSTER).

1907. FÖRSTER, Fasc. Malay. Zool. 4, p. 10 - 11 (sep.) — ♂ (juv.) ♀ Bukit Besar (*Platysticta*).

1) Rec. Ind. Mus. 19, 1920, p. 154 - 155. In LAIDLAW's text-fig. 3 of the thoracic colour-pattern, moreover, these side-spots are not shown, possibly because of the dense powdery substance which covers the sides of the adult insect?

2) Archiv f. Hydrobiol. Suppl. 13, 1934, p. 331 - 334, figs. 20, 22 - 27.

1924. LAIDLAW, J. Mal. Br. Roy. As. Soc. 2, p. 304 - 305, pl. 5 fig. 7 (♂ apps. sub *sharpei*). — ♂ Jor in Perak.
1931. LAIDLAW, J. Fed. Mal. States Mus. 16, p. 189. — ♂ Pahang.
1934. FRASER, Stylops, 3, p. 136 - 137, fig. 3 (♂ apps.) — ♂ East Mergui.

Material studied: — 1 ♂ (semiad., pinned), labelled: "Prov. Kelantan, Ost-Malacca, Rolle vdt. 1903, leg. Waterstradt/*Platysticta quadrata* De Selys ♂", both labels in FÖRSTER's hand. In the University Museum of Michigan, Ann Arbor.

This is evidently the specimen referred to by LAIDLAW (loc. cit. 1931, p. 189) as having been recorded by FÖRSTER sub *P. quadrata* SELYS, without comments. Its measurements are: abd. + app. 41, hw. 23.5 mm (not 40 and 29, respectively, as given by FÖRSTER!). Postnodals and subpostnodals $\frac{13\,13}{12{,}12}$. Anal veins present in all wings, their position similar to LAIDLAW's specimen from Pahang.

The actual specimen, though not fully coloured, is in good condition and fits LAIDLAW's descriptions of *D. sharpi* (1924 and 1931) closely, as also FRASER's account of the Mergui specimen. Especially the decidedly pentagonal shape of the pterostigma and the doubled costal cells posterior to it, seem to be distinctive features of this species (fig. 5a). The structure of the anal appendages is almost exactly alike FRASER's drawing of these organs from a specimen of Mergui. This author was the first to mention the inwardly directed, fine black spine on the inner side to the base of the apical portion of the inferior appendages (fig. 4).

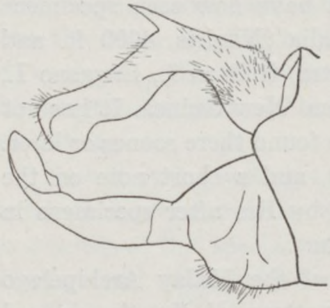

Fig. 4. *Drepanosticta sharpi* (LAID.), Kelantan. Male anal apps., right side.

I admit that the body-measurements of *sharpi*, as given by LAIDLAW and FRASER, are reliable; LAIDLAW (1907, 1924 and 1931) gives 42 (teneral type), 45 and 40, respectively, for the abdomen; 23 (type), 25 and 22.5, respectively, for the hind wing; FRASER's specimen measured 49 for the abdomen and 26 for the hind wing; lastly, the measurements of FÖRSTER's male are noted above. This would suggest a great variability in size of the male of *D. sharpi*, viz. abd. + app. 40 - 49, hw. 22.5 - 26 mm.

The differences between *sharpi* and the next species, *fontinalis*, sp. n., are enumerated under that species.

Drepanosticta fontinalis, sp. n. (fig. 5b, 6).

Material studied: — 1 ♂ (ad., pinned and relaxed), labelled: "Kelantan Ost Malacca, Heine vdt. 1903/*Platysticta quadrata kelantana* n. rasse Förster", both labels in FÖRSTER's hand. In the University Museum of Michigan, Ann Arbor.

Male (holotype). — Labium pale yellow. Labrum, anteclypeus and dorsal two-thirds of the mandible-bases ivory-yellow; labrum with the anterior border

sharply defined black, the black margin just visible from above. Postclypeus shining black. Frons and vertex shiny bronzy-green with purplish reflections on middle, rear of the head bronzy-black. First joint of antennae brown, the second joint yellow, brownish apically, flagellum brown. Parorbital carina barely indicated, transverse postoccipital carina very low, the side-edges small, obtuse-angulate.

Prothorax pale on anterior half, black posteriorly. Anterior lobe and the dorsal tubercles of the middle lobe ivory-yellow, the former with an irregular, transverse, black stripe along its front margin; sides of middle lobe dirty yellowish turning to black posteriorly. Posterior lobe black, short and broad, depressed, slightly widened distally, with the side-edges rectangular, very little projecting, rounded apically.

Dorsum of synthorax, as far down as the first lateral suture, deep bronzy-black, the surface rather dull and covered with microscopical striae, except the mesinfraepisternites, the lower (convex) portion of each mesepimerite, and the dorsal ends of the mesepisternites, which are smooth and shining. Sides pale green, with a broad, slightly oblique, black band, covering the posterior three-fifths of metepisternum and posteriorly surpassing the second suture for a short stretch, passing downwards to the level of the spiracle to acquire ventrally and posteriorly a rusty-brown colour. The green fascia thus enclosed is decidedly narrower than the black lateral band behind it, especially on dorsal end; it tapers dorsally but ventrally surrounds the spiracle, acquiring soon a dull yellow colour, and thence passes downwards to the second pair of coxae, which are also yellowish, as is the lower third of the metinfraepisternites. Metepimerites green dorsally, fading to dull yellow ventrally and underneath.

Coxae, trochanters and legs dull yellow; all femora with a complete, sharply defined, deep black exterior line and diffuse brown postmedian rings. Last tarsal joint blackish apically; spines brown, claws reddish.

Wings hyaline, basal veins reddish-brown. Anal veins present in all wings, their position similar to *sharpi*, hence not forming an Y-shaped brace. Postnodals and subpostnodals coincident, $\frac{15.15}{13.13}$. Pterostigma quadrangular, costal side shorter than anal side, deep black surrounded by a fine pale line; cross-veins posterior to the pterostigma not divided (5b).

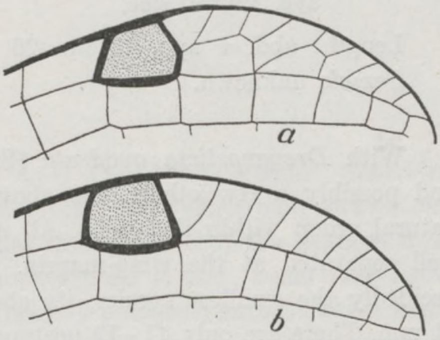

Fig. 5. Apex of right front wing of *a*, *D. sharpi* (LAID.), and *b*, of *D. fontinalis*, sp. n., both from Kelantan. Males.

Abdomen long and slender. Segm. 1 pale yellow (possibly greenish in life), shading into black posteriorly, and with the dorsal apical membrane pale. Dorsum of segm. 2 dark brown, sides yellow; the dorsal black mark rapidly

expands posteriorly so as to cover also part of the sides (bordering-line in profile view running obliquely from antero-dorsal to postero-ventral edge of segment). Segm. 3 - 5 blackish-brown with diffuse light basal rings, pale brown dorsally and yellow laterally, occupying about one-sixth of the length, and similarly coloured postmedian rings occupying about one-fifth of the length of segment; terminal black rings sharply delimited and of the same length as the pale basal rings. On segm. 6 the anterior pale ring is smaller, dimly defined dorsally, and the subterminal ring is almost invisible. Segm. 7 black. Segm. 8 blue with a deep black dorso-lateral marking, irregularly rounded posteriorly and extending rather further apicad dorsally than laterally, occupying the basal two-thirds on mid-dorsum, slightly more than the basal half on the sides; lower margin of the tergite bordered with blue; there is, besides, a comma-shaped black spot placed about the postero-lateral edge of the segment and attached to the hind margin. (These black spots merge one into the other in our specimen of *sharpi*). Segm. 9 entirely blue, save for a transverse, black, dorsal basal stripe and a thick black stripe along the entire lower margin of the segment. Segm. 10 black.

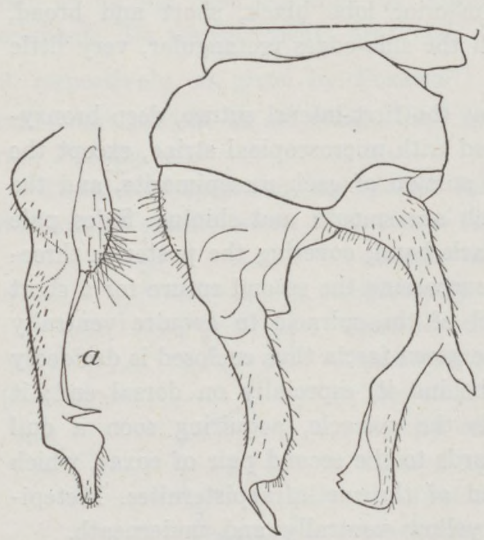

Fig. 6. ***Drepanosticta fontinalis*, sp. n. Male anal apps., left side; *a*, right inferior app., ventral side.**

Anal appendages black, shaped as described *postea* (fig. 6).

Length: abd. + app. 42, hw. 25 mm.

Female unknown.

With *Drepanosticta quadrata* (SELYS), *viridis* FRASER, *sharpi* (LAIDLAW) and possibly a few others, the above described *fontinalis* seems to form a natural group within the genus. All of them have the anal veins *Ac* and *Ab* well separated at the wing-margin. Of these, *quadrata,* from Singapore, is decidedly the smallest species, its abdomen measuring 35 and the hind wing 21 mm. There are only 11 - 12 postnodals in the wings. It is not possible from the description alone to give further distinctive features of *quadrata,* of which only the type is known.

D. viridis, from Mergui, Lower Burma, is distinguished from the other species of the group by the extreme length and attenuation of its abdomen, which is exactly double the length of the wings. The males of the two other, similarly coloured species, *sharpi* and *fontinalis,* differ markedly from each

other in the shape of their anal apps., but it is a matter of some little difficulty to tabulate these differences and to determine the limits of variation of these species. The occurrence in close vicinity is interesting but more material of both of them is necessary to reveal some more differences in the body-colouring and to confirm the striking peculiarities found in the region of the pterostigma of the former species.

sharpi (Kelantan).	*fontinalis* (Kelantan).
Thorax with the dark stripe along 2nd lateral suture not or hardly entering the metepimeral space posteriorly, distinctly narrower at level of the spiracle than the pale metepisternal fascia anterior to it.	Thorax with the dark stripe along 2nd lateral suture broad, entering the metepimeral space posteriorly, equally broad at level of the spiracle to the pale metepisternal fascia anterior to it.
Pterostigma pentagonal, the outer margin broken below its middle, followed by two irregular rows of cells (interchanged alternately by a single cell in three of the wings) (fig. 5).	Pterostigma quadrangular, followed by a single row of cells (fig. 5).
The blue spot on dorsum of segm. 8 strongly convex anteriorly, its border curving gently downwards and *backwards,* meeting the posterior margin of the segment about half-way down, so that the lower half of the posterolateral portion of the segment remains black and well separated from a pale stripe along lower margin of the tergite.	The blue spot on dorsum of segm. 8 concave anteriorly, its border curving downwards and *forwards,* so that the entire lower half of the segment remains blue.
Anal apps. of compact build. Superiors in profile view shaped like the head of a race horse with the basal half shaped much like its neck and the apical portion rather like its (long and grotesque) muzzle. Inf. app. without angular mid-dorsal projection at the end of the basal third; apical twisted portion gently upcurved, spoon-shaped (fig. 4).	Anal apps. very slender. Superiors in profile view much more drawn out and thinner, so that the likeness to a horse's head is lost; basal half more abruptly narrowed with its lower margin strongly concave, apical half slenderer, definitely parallel-sided subapically. Inf. app. with a distinct mid-dorsal angular projection at the end of the distal third; apical twisted portion more abruptly narrowed and slenderly lanceolate (fig. 6).

Drepanosticta pytho, sp. n. (fig. 7).

Material studied: — W. Sumatra, 1 ♂ (semiad.), Padang, 1913 (? ROLLE vend.), labelled on the enveloppe: "Platysticta, Grosskopf, W. Sumatra, Padang", in FÖRSTER's handwriting. Holotype in the FÖRSTER collection, now in the University Museum of Michigan, Ann Arbor (no. 1252).

Male (semiad.) — Labium pale yellow. Labrum, anteclypeus and dorsal portion of the mandible-bases creamy-white; labrum with the anterior border sharply defined black, the black margin visible from above. Postclypeus shining black. Frons and vertex bronzy-green, rear of the head glossy black. Antennae with the first two joints yellow, the flagellum brown. Parorbital and transverse postoccipital carinae not developed, barely indicated.

Prothorax pale greenish-yellow, the posterior lobe black. Posterior lobe with the lateral posterior margin produced as very long and filamentous projections, which are directed obliquely upwards and backwards; apices very thin and apparently obtusely pointed, with no apical enlargement or tuft of hairs; in lateral aspect these processes are a little longer than the prothorax itself.

Dorsum of synthorax, as far down as the first lateral suture and including the mesinfraepisternites, shining bronzy-black, with purple reflections. Over the middle of the dorsum, joining the median carina on both sides, runs a narrow, pale yellow stripe, about 0.7 mm broad on its widest (lower) point, diminishing gradually in width upwards, where it is very narrow, tapering to a point about 1 mm below the ante-alar triangles, which themselves are ochreous-brown (possibly bronzy-black in the adult insect). Thoracic sides bright greenish-yellow, marked with a complete, bronzy-black band over the second suture which is widest on its dorsal end (about same width as the metepisternal pale band), slightly outbent at level of the spiracle, which is surrounded by yellow, and continued downwards between the coxae of the middle and posterior pair of legs. Metinfraepisternites with the posterior third yellow. Metepimerum, coxae and under surfaces of thorax pale yellow.

Legs pale yellow; all femora with indistinct greyish-brown median rings and the extremities also darkened; apical third of last tarsal joint black. Spines brownish-yellow.

Wings long and very narrow; hyaline. Postnodals $\frac{13.13}{12.12}$; sub-postnodals 12 in all wings. Y-shaped vein sessile (stem wanting), V-shaped. Pterostigma reddish-brown, subquadrangular, proximal side slightly oblique, hence costal side distinctly shorter than anal side, surmounting one cell.

Abdomen attenuated and enormously drawn out, almost twice longer than hind wing. Dorsum of segm. 1 brown, sides yellow and posterior margin blackish laterally Segm. 2 with a brown dorsal marking, narrowed anteriorly, the basal third of which deepens in colour to almost black; over the middle of this segment runs a fine yellow line which is widened and sharply defined anteriorly. Segm. 3 - 7 brown, these segments progressively darker from before backwards; 3 with vestiges of yellow dorsal spots, and bases of 3 - 6 with pale yellow basal

markings restricted to the sides and underneath, extending further apicad ventrally than laterally. Dorsum of segm. 8 - 10 deep black, sides dark brown; basal third of 8 with a complete, clear blue ring; sides of 9 and 10 very dark brown.

Anal appendages dark brown, inferior tooth of superiors and apices of inferior appendages black. Superiors in dorsal view slender and well separated at origin though evenly turned inwards and hence rather approximated towards apices; exteriorly almost straight, with a slight convexity at ⅓ of their length, interiorly also straight but abruptly incurved at the same point and hollowed out so as to form a narrow, sub-apical rounded projection, invisible in lateral view, the apices turned mesiad, distinctly expanded, depressedly hoof-shaped, the tips overlapping; in lateral view the sup. apps. are semicircularly curved ventrad and apicad, the basal two-thirds cylindrical, furnished with a strong spine-like interior tooth, which is directed ventrad; apices rather expanded, shaped as in fig. 7. The inferior apps. are shorter than the superiors, straight and irregularly tapered, provided half-way their length with a blunt interior projection, and at ¾ their length with a curved and finely pointed interior tooth, which is turned dorsad and caudo-mesiad; distal portion of each twisted on itself, with a subapical enlargement, the apex finely pointed, directed backwards and slightly outwards. Penis with the shaft-spines identical in size and arrangement to those of *D. kruegeri, sundana* and *arcuata*.

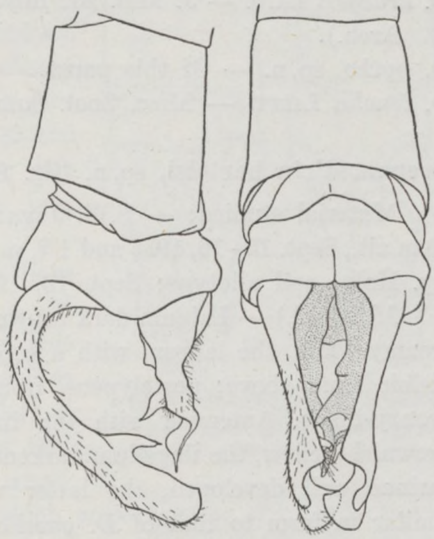

Fig. 7. *Drepanosticta pytho*, sp. n. Male anal apps., right side and dorsal view.

Length: abd. + app. 48, hw. 26 mm.

Female unknown.

This new species is abundantly distinguished from all other Malaysian species by the extreme slenderness of the abdomen and wings. It differs from the members of the *sundana*-group, especially *arcuata* Lieft., by the longer processes of the prothoracic hind-lobe, by the pale stripe joining the median carina of the thorax, by the much longer abdomen, by the different armature of the curiously bent upper anal appendages, and by details of coloration. From *D. bispina* Fras. and *D. tenella* Lieft., both also from Sumatra, *pytho* differs by its larger size. It is easily differentiated from *bispina*, of which only one imperfect female has been made known, by the colouring of the legs, thorax and abdomen.

(It would appear to me that it is not worthy of recommendation to describe as new species imperfect females, nor even complete examples of that sex, of the genus *Drepanosticta*).

The following species are now known from Sumatra and the satellite islands:—

D. arcuata LIEFT. — Treubia, 14, 1934, p. 469 - 471.

D. bispina FRAS. — Mém. Mus. Royal d'Hist. Nat. Belg. (hors série), 1932, p. 5 - 6.

D. kruegeri LAID. — J. Mal. Br. Roy. As. Soc. 4, 1926, p. 228 - 229 (Mentawei Arch.).

D. pytho, sp. n. — Of this paper.

D. tenella LIEFT. — Misc. Zool. Sum. XCII + XCIII, 1935, p. 7.

Drepanosticta bartelsi, sp. n. (fig. 8).

Material studied: — S.W. Java: 3 ♂, 2 ♀, Tjidamar, near Tjitoë, about 40 m alt., Sept. 13 - 16, 1935 and 1 ♀, same locality, Nov. 28, 1935, M. BARTELS Jr. leg. Holo- and allotype: Sept. 13, 1935.

Male (ad.) — Labium dark brown. Labrum, mandible-base and anteclypeus creamy-white, the labrum with a broad, dark brown anterior border, scarcely visible from above; postclypeus, frons, vertex and rear of the head brilliant bronzy-black. Antennae with the first joint dark brown, the second joint brownish-yellow, the flagellum darkened. Parorbital and transverse postoccipital carinae well developed, the latter with obtuse-angulate lateral extremities, similar in form to that of *D. gazella* LIEFT.

Prothorax bright creamy-yellow, the anterior and posterior lobes wholly black. Posterior lobe with the lateral posterior margins produced as very long and slender projections, directed straight upwards; in caudal view each of these finger-like processes is slightly outbent on middle, flattened in the transverse plane, with no apical enlargement or tuft of hairs, the tips being almost pointed; in lateral view the processes appear equal in length to the prothorax itself and are very slightly forwardly curved.

Synthorax throughout bronzy-black, very shining. Metepisternum, from the spiracle upwards to almost reaching the upper margin of that space, with a sharply delimited, creamy-yellow band along the first lateral suture, which covers the anterior three-fifths of the metepisternite; lower end of this stripe rather pointed, upper end rounded. Metepimerum for the greater part bronzy-black but about the dorsal third of this space pale flesh-coloured, the transition-line sharply delimited, oblique. Under surfaces deep bronzy-black, except the posterior two-fifths, which are pale flesh-coloured.

Coxae and legs pale yellow; all femora with indistinct greyish-brown postmedian rings and the extremities black; apical half of last tarsal joint also darkened. Spines yellowish.

Wings hyaline. Postnodals $\frac{13-14}{12-13}$, subpostnodals $\frac{13}{12}$. Y-shaped vein almost

sessile, or with a very short stem. Pterostigma warm cinnamon-brown, subquadrangular, costal side distinctly shorter than anal side, basal side not curved but oblique, distal side convex.

Abdomen dark brown; first segment yellowish, slightly darkened above; sides of 2 also yellowish, dorsum more darkened; 3-7 each with a pale yellow basal ring, widest laterally and not sharply defined posteriorly, occupying about one-fourth, that on 7 about one-third of the length of segment. Segm. 8 blackish-brown, basal half of sides yellow. Tergite of segm. 9 sharply defined pure azure-blue, this colour extending also a little over the sides, which are deep black (the black colour invisible from above). Segm. 10 and anal appendages black, apices of superior pair brownish (fig. 8). Penis with numerous long shaft-spines.

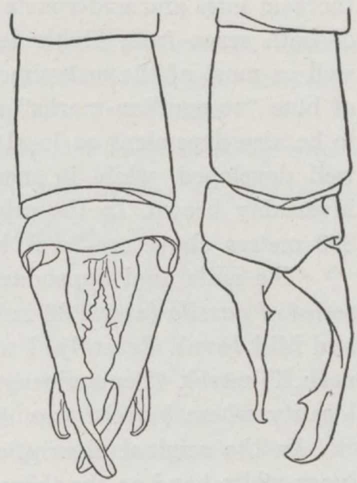

Fig. 8. *Drepanosticta bartelsi*, sp. n. Type. Male anal apps., dorsal view and left side.

Female (ad., allotype). — Only differs from the male as follows: — Labrum light blue, the anterior border brownish-black. Posterior lobe of prothorax of simple structure, lateral posterior margin without any projections other than a very low convexity on each side; posterior lobe itself in the form of a depressed, shortly trapezoidal plain figure, the lateral sides of which converge and the hind margin being straight.

Postnodals $\frac{13-15}{12-13}$, subpostnodals $\frac{12-13}{11-12}$. Wing-tips slightly smoky.

Abdomen widening distally, pale markings on segm. 7 obscure. Distal two-thirds of the 9th tergite, with the exception of the lower portion of the sides, sky-blue, limits indistinct. Segm. 10 very small, dark brown. Anal appendages subequal in length to segm. 10, conical, black. Valves blackish-brown, slender, lower margin very slightly convex, apices projecting well beyond the tips of appendages.

Female (paratypes). — Differ very markedly from the allotype female by the prothoracic hind-lobe carrying the same long projections on each side as are found in the male; these processes are but little shorter and either slightly less or, in the second specimen, slightly more forwardly bent than in the male, but otherwise are very similar.

Length: ♂ abd. + app. 31 - 32.5, hw. 19 - 20; ♀ 28.5 - 29.5, 19 - 20.5 mm.

I have much pleasure in naming this new species after Max Bartels Jr., who since 1935 has sent me a vast amount of material and field-notes on Javan and Sumatran Odonata.

Closely related to *D. gazella* Lieft., also from Java, but differing from that species by the longer and slenderer horns at the posterior lobe of the

prothorax and by the much longer and straighter anal appendages of the male; the sub-apical inferior tooth of the superior pair of appendages is decidedly smaller and the inferiors are not so long as in *gazella*. Colour-differences are slight and not of much value in discriminating the two species, for, in specimens of *gazella* from low country, the extension of the bronzy-black pattern on the thoracic sides and underparts is identical to that of *bartelsi,* whereas in a series of both sexes from higher levelled localities, the underside of the thorax as well as most of the metepimerites, are pale in colour. The presence or absence of blue "recognition-marks" on the ninth abdominal segment of *gazella* seems to be also dependent on local influences; in lowland specimens they are always well developed, while in mountain specimens of West Java this segment is invariably brown. In the original series from Mt. Slamat (Mid Java), about 800 metres above sea-level, however, segm. 9 is blue in both sexes.

The male anal appendages are short and strongly curved throughout our series of *gazella* (about 80 individuals examined from various localities in West and Mid Java). Recently, I took a long series of typical *gazella* in heavy forest near Tjimerak (Penandjoeng Bay, 200 m alt.), about 90 miles east of the locality where *bartelsi* was discovered.

In the original description of *gazella* I have erroneously stated that the ivory-white band on the thoracic sides runs over the mesepimerum; it should be read: metepisternum (see: Tijdschr. v. Ent. 72, 1929, p. 110 and 114). In this species the shaft-spines of the penis are equally well developed as in *bartelsi, spatulifera* and the *sundana*-group of species.

Drepanosticta ephippiata, sp. n. (fig. 9).

Material studied: — N. Celebes: 2 ♂ (ad.), Tondano near Manado, April 1935, C. VAN BRAEKEL leg., acq. June 11, 1935.

Male (ad.). — Labium brown. Labrum, anteclypeus, mandible-bases and mesal portion of the genae, creamy-yellow; labrum with the anterior border well defined dark brown, the black margin visible from above. Genae with a black stripe ascending along margin of compound eyes. Frons and vertex bronzy-black, rear of the head metallic greenish-black, very shining. Antennae yellowish, flagellum brown. Parorbital and transverse postoccipital carinae well developed, the former low and rounded, the latter with acutely angulate lateral extremities.

Prothorax bronzy-brown, mottled with dull yellow, the anterior lobe yellow except on middle; the posterior lobe produced posteriorly as two caudally directed, pale yellow processes, extending dorsally over the synthorax, in dorsal view shaped much as in *D. lymetta* COWLEY (Philippines), but with the widened apical part depressed, distinctly swollen, smoothly shining and in the form of slightly divergent, shortly stalked halteres, which are about 1½ times longer than the posterior lobe itself and entirely devoid of apical hairs.

Synthorax bronzy-brown, finely punctured above and on most of the mesepimerites and hence not very shining on these parts; lower portion of mesepi-

merum and most of the metepimerum appearing darker, scarcely punctured, shiny black at certain angles. A well defined, elongate, creamy-yellow band extending from the spiracle upwards to near the dorsal margin of the metepisternum, rounded on both ends and scarcely widened dorsally; about the dorsal third of the metepimerum pale yellow. Venter black on anterior half, pale yellow behind.

Coxae and legs pale yellow; all femora with distinct brown postmedian rings and the extremities blackish-brown; apex of the last tarsal joint darkened. Spines brownish-yellow.

Wings of the usual shape, hyaline. Postnodals and subpostnodals coincident, $\frac{15-16}{14-15}$. Y-shaped vein sessile (stem wanting). Pterostigma reddish-brown, subquadrangular, the proximal side but slightly oblique.

Abdomen slender, of the usual form. Segm. 1 - 2 blackish-brown, 1 unmarked, 2 with a basal yellow spot each side. Segm. 3 - 6 black, each with a complete basal yellow ring, extending slightly further apicad laterally than dorsally, occupying the basal one-sixth to one-seventh (lateral view); 7 dark brown with the basal pale rings indistinct, occupying one-fourth of the length; 8 - 10 black, unmarked. Sternites coloured similarly to the tergites, except the eighth that bears a conspicuous basal yellow mark.

Anal appendages short, entirely yellow, the superior pair about three times the length of segm. 10, the inferiors subequal to the superior pair. In dorsal view the superiors broad basally, each with a short, acute, tooth-like spine along upper margin, directed mesiad, at about half-way its length; slightly twisted and hollowed out mesially, gradually narrowed apically, the apices broadly rounded; in lateral view straight, very broad basally but tapering rapidly, the tips rounded. Inferior appendages widest basally, in dorsal view with the apical half parallel-sided and straight exteriorly, the apices strongly turned mesiad; interiorly also straight with a preapical mesial projection, thereafter strongly concave, tips narrow; in profile view almost straight, the apices slender and turned mesiad, without tufts of hairs (fig. 9).

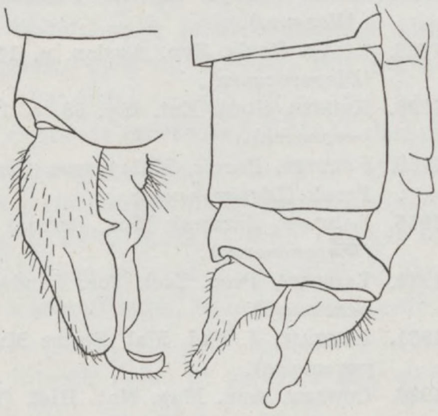
Fig. 9. *Drepanosticta ephippiata*, sp. n. Type. Male anal apps., dorsal view (left half) and right side.

Penis not different in principle from that of *D. mylitta* COWLEY, and allies; shaft-spines long and fine, though not very numerous.

Length: abd. + app. 31.5 (holotype) — 32.2, hw. 21 (holotype) — 22 mm.

Female unknown.

A small species, evidently allied to a group of Philippine species, recently described by COWLEY (Descriptions of three new species of *Drepanosticta* (Odonata) from the Philippine Islands, Trans. Royal Ent. Soc. London, 85, 1936, p. 157 - 168, figs.). It differs from all these by the complete pale band over the thoracic sides, and by the knob-like tubercles along the margin of the posterior lobe of the prothorax. Possibly most closely related to *D. megametta* COWLEY. It is the first member of the genus known from Celebes.

Fam. PROTONEURIDAE.

The Malaysian species of *Elattoneura* COWLEY.

The most recent classification of the "*Disparoneura*-complex", a reference to which is given under each species discussed in the following pages, is that suggested by J. COWLEY, whose arrangement of the various genera composing it will be adopted by the writer.

Malaysia is inhabited by four species of *Elattoneura* (*Disparoneura* olim), two of which are here described for the first time. For an enumeration of the remaining species, all of which are of a more western occurrence, the reader is referred to COWLEY's paper. One may, with tolerable confidence, predict more additions to the Malaysian fauna, though there is reason to suspect that the genus will prove not to occur more eastward than Borneo.

Elattoneura analis (SELYS) (fig. 10a, 11a).

1860. SELYS, Synops. Agrion. Proton. p. 23 - 24 sep. — ♂♀ Mt. Ophir, Malaya (*Alloneura*).
1886. SELYS, Revis. Syn. Agrion. p. 161 (key), 169 sep. (note). — Same specimens (*Disparoneura*).
1898. KRÜGER, Stett. Ent. Ztg. 59, p. 111 (no descr.). — ♂ def. N.E. Sumatra (*Disparoneura*).
1907. FÖRSTER, Fascic. Malayenses, Zool. 4, p. 11 (no descr.) — ♂ Kuala Kangsar, Perak (*Disparoneura*).
1915. LAIDLAW, Sarawak Mus. Journal, 2, p. 275 (no descr.). — ♂ Baram, Sarawak (*Disparoneura*).
1920. LAIDLAW, Proc. Zool. Soc. London, p. 340 (no descr.) — ♂ N. Borneo (*Disparoneura*).
1931. LAIDLAW, J. Fed. Mal. States Mus. 16, p. 190 (no descr.) — ♂ Pahang (*Disparoneura*).
1936. COWLEY, Ann. Mag. Nat. Hist. (10) 17, p. 518, 523 (synonymy).

Material studied: — Malay Peninsula: 2 ♂ (abdomen partly missing), Kuala Kangsar, Perak, ROLLE vend. 1903 - 1904, labelled "*Disp. analis* SELYS", (in FÖRSTER's hand); pinned specimens in the University Museum of Michigan, Ann Arbor. — W. Borneo: 7 ♂, Singkawang, Piong San Rd. and Tjapkala Rd., April 4 1932 and Dec. 9, 1931; 1 ♂, id., Mampawa, forest-stream near Andjoengan, March 19, 1932; 7 ♂, id., Bengkajang, forest-stream, April-July 1932 and June-Oct., 1933; all L. COOMANS DE RUITER leg. N.W. Borneo, Sarawak,

Lio Matu, Nov. 1, 1914, J. C. Moulton leg., determined as *analis* by Dr. F. F. Laidlaw and in his collection.

Male (W. Borneo & Perak). — Anterior surface of the head chrome-yellow to orange. A small, longitudinal black impression on the middle of the labrum. Postclypeus and frons black. A broad, parallel, transverse orange band between the eyes, the borders of which are slightly irregular. Remainder of head black. Antennal joints brownish or orangish basally.

Prothorax: dorsum and sides black; median division with a large, angular dorso-lateral marking and with three pairs of orange spots on mid-dorsum, two of which are placed upon middle of anterior lobe; posterior lobe entire, orange in colour, the median third black.

Fig. 10. Diagrams of colour-pattern of synthorax; *a, Elattoneura analis* (Selys) ♂; *b, E. longispina*, sp. n., ♂; *c, E. longispina*, sp. n., ♀. W. Borneo.

Synthorax dark bronzy-green, marked with orange, as in fig. 10a. Venter pale yellow. Legs pale orange, femora with indistinct subapical rings and a brown mottling along the outer sides. Tibiae and tarsi yellowish, darkened interiorly.

Pterostigma sepia-coloured or blackish-brown. Postnodals $\frac{13-15}{11-13}$.

Abdomen: segm. 1 dark brown with a triangular yellow side-spot and the articulation orange. Segm. 2 black with a yellow stripe along lower margin, a small side-spot of the same colour near distal border (often connected with the lower stripe), and a large leaf-like orange spot on dorsum; this dorsal spot is either isolated or connected with the distal margin by a fine line. Extreme bases of segm. 3 - 6 orange, these segments otherwise lighter to darker brown, with long blackish-brown apical rings and narrow sub-apical yellow annules. The brown ground-colour of these segments gradually deepens posteriorly and is almost black on segm. 6. Segm. 7 - 10 black, 7 with vestiges of two basal yellow spots and with the articulations between 7 - 8 and 8 - 9 also yellow. Distal $^1/_3$ to $^2/_5$ of segm. 9 and the whole of segm. 10 orange on dorsum, sides black.

Anal appendages orange, tips of the interior spine of superior pair and apices of inferior pair black (fig. 11a).

Length: abd. + app. 27 - 30.5, hw. 16 - 17.5 mm. (♂ Sarawak: 33, 20 mm).

Female. — A full description of this sex has never been published. Selys' notes on the structure of the prothoracic hind-lobe are quoted *postea*. In the original description the following notes on the colouring are given: "Bandes du thorax d'un vert pâle; la tache du 2e segment en raie. Appendices courts, larges."

I have not seen examples.

Elattoneura longispina, sp. n. (figs. 10 b-c, 11b, 12).

Material studied: — W. Borneo: 1 ♂ Pontianak, Peniti River, Febr. 24, 1931: 2 ♂, Singkawang, Tjapkala Rd., April 4, 1932; 13 ♂, 2 ♀, id., forest-marsh near Bakoean, Febr. 17, 1932 (including holo- and allotype), Jan. 22, 1933 and Jan. 22, 1934. All L. COOMANS DE RUITER leg. — C. Billiton I: 11 ♂, 5 ♀, Aer Madoe, Jan. 20, 1936, F. J. KUIPER leg.

Closely allied to *E. analis*.

Male (ad., W. Borneo). — Anterior surface of the head pure cream-coloured to bright citron-yellow. Labrum with a fine dark mid-basal impression and sometimes with an extremely narrow black border. Anteclypeus in most specimens with two diffuse brownish spots on either side of the middle. Postclypeus and frons black. A rather narrow, bright orange spot, concave anteriorly and convex posteriorly, between each of the lateral ocelli and the margin of compound eye; mesially, the limits of these two spots fade away and merge into the black on the middle of the vertex so as to form a discontinuous transverse band between the eyes. Remainder of head black.

Prothorax black; the dorso-lateral orange markings more reduced than in *analis;* a large triangular spot on each side upon the median division coalescing anteriorly with a side-spot upon the anterior lobe, and vestiges only of orangish spots on the middle of the latter; posterior lobe entire, black in colour, only the lateral edges orange.

Synthorax dark bronzy-green, similarly marked with orange as in *analis* but antehumeral stripes narrower and posterior edge of the metepimerum usually less spotted with black. Venter pale (fig. 10b).

Legs and wing-neuration not different from *analis*. Pterostigma sepia-coloured. Postnodals $\frac{11-14}{11-12}$. Tips decidedly more rounded than in *analis*.

Abdomen: segm. 1 black with the yellow side-marking larger and irregular in outline; articulations orange. Segm. 2 with the sides more extensively yellow than in *analis,* so as to surround a complete, bronzy-black dorso-lateral band which is rather constricted beyond the middle, and, on mid-dorsum, is completely divided into two portions by a very fine orange median line; this line scarcely broadens mid-way its length and in most individuals does not reach the posterior margin of the segment. Segm. 3 - 6 similarly coloured to *analis* but the basal orange spots interrupted on middle. Segm. 7 - 10 black, the basal lunules of 7 vestigial or absent and articulations between 7 - 8 also dark in colour; 10 with an orange spot, narrowed basally, upon mid-dorsum; articulations between 9 - 10 and a very low triangular spot covering the apical fifth of 9, also pale-coloured; or apical segments wholly black.

Anal appendages orange, tips darkened; or almost black (fig. 11b).

Male (juv.) — Pale colours of head and thorax light blue instead of orange. Abdomen with the first six segments light sepia-coloured marked with white spots and dark brown terminal rings. Pale spots on segm. 10 and 9 whitish, as are also the appendages.

With age and maturity the body-colouring passes through blue, greenish-yellow and pale orange stages to finally acquiring the deep orange tint of the adult.

Male (juv.-ad., Billiton). — All except two males are of the blue colour-stage in which only the transverse fascia between the eyes is more or less orange-coloured; in the two sub-adult specimens the head-markings and antehumeral stripes are bright orange but the thoracic sides have remained blue. No structural or size-differences.

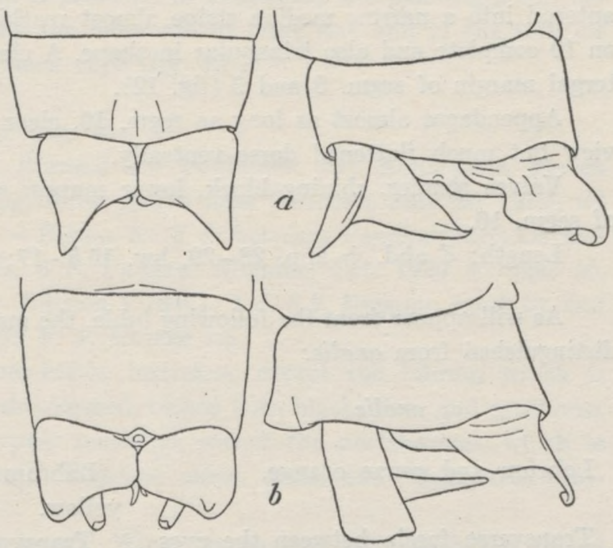

Fig. 11. Male anal apps. of *a*, *Elattoneura analis* (SELYS), dorsal view and right side, and *b*, of *E. longispina*, sp. n. W. Borneo.

Female (Borneo and Billiton). — Differs from the male only in that the light colours of the thorax and abdomen are paler, those of the head being more extensive. Labrum, genae and mandible-bases pale yellow to light blue; labrum with a black median point and postclypeus irregularly striped with blue along base (not wholly black, as in the male). The transverse pale band between the eyes is blue instead of orange, of even width throughout and not interrupted on middle.

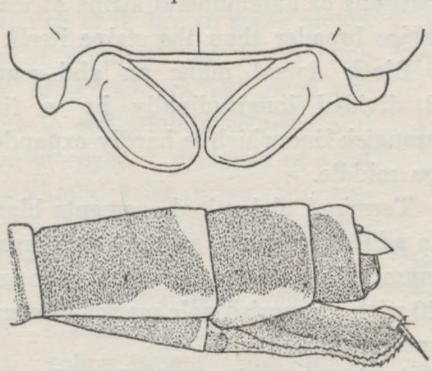

Fig. 12. *Elattoneura longispina*, sp. n. ♀, W. Borneo. Posterior lobe of prothorax (dorsal view), and terminal segments of abdomen (left lateral view).

Prothorax black, marked with pale blue as in the male; posterior lobe depressed, strongly modified, entirely divided into two ear-like lobes, the side-edges of which only are blue in colour (fig. 12).

Synthorax bronzy-green; pale markings identical to the male. Antehumeral stripes blue, sides paler, turning to yellowish or white underneath (fig. 10c).

Legs yellowish, the brown mottling and rings more definite than in the male. Wings as in the opposite sex.

Abdomen with the bronzy-black marking on the back of segm. 2 constricted after the middle and divided longitudinally by a fine white line; sides of this segment with a diffuse brownish posterior spot. Basal and subterminal annules

of 3 - 7 very distinct, those of segm. 7 small, and restricted to the sides. Segm. 8, 9 and 10 deep black, dorsum of each with a very conspicuous, light blue apical spot, widest posteriorly, that on 8 triangular in form and occupying about $^1/_6$ to $^1/_3$ of the length, that on 9 suddenly constricted and produced anterad into a narrow median stripe almost reaching the end of segm. 8, that on 10 complete and also triangular in shape. A clear yellow stripe along lower tergal margin of segm. 8 and 9 (fig. 12).

Appendages almost as long as segm. 10, clear yellow, triangular in dorsal view but much flattened dorso-ventrally.

Valves slender, shining black, lower margin straight, tips surpassing end of segm. 10.

Length: ♂ abd. + app. 28 - 29, hw. 16.5 - 17; ♀ 27 - 29, 17 - 18 mm.

As will appear from the following table, the males of this species are easily distinguished from *analis:*

analis	*longispina*
Labrum and genae orange.	Labrum and genae citron- or creamy-yellow.
Transverse fascia between the eyes broad and complete, bright orange.	Transverse fascia between the eyes narrower and obliterated on middle of vertex, deep orange-red.
Median division of prothorax with orange twin-spot, mid-dorsally.	No orange spots on middle of prothorax.
Black interspace between ventral portions of antehumeral stripe about 1½ times broader than the stripe itself.	Black interspace between ventral portions of antehumeral stripe at least twice broader than the stripe itself.
Black dorsal mark on abd-segm. 2 divided into two equal portions by an oval orange spot which is pointed anteriorly and stalked posteriorly.	Black dorsal mark on abd.-segm. 2 divided longitudinally by a fine orangish line which is hardly expanded on middle.
Articulations between segm. 8 - 9, dorsum of 10 and distal half of dorsum of 9 orange.	Terminal abdominal segments black in adult specimens; segm. 9 at a maximum with a triangular apical spot and 10 with a squarish pale mark in teneral specimens only.
Anal apps. orange. Superiors in dorsal view broad with narrow, pointed tips, provided interiorly with a large, acutely pointed, shelf-like projection. Inf. apps. large, apices narrowed and incurved.	Anal apps. obscured. Superiors in dorsal view flattened and obtuse, in side-view abruptly and almost rectangularly truncated; inner projection in the form of a very long and narrow inferior spur. Inf. apps. broad at base, distal half abruptly narrowed, with slenderly incurved end-hooks.

Although I have not seen specimens, the female of *analis* seems to differ from *longispina* by the shape of the posterior lobe of its prothorax: "Lobe postérieur du prothorax très-largement échancré, les côtés formant deux lobes élevés en pointe et deux lobes déprimés". In *longispina* the side-edges are depressed and rounded off, while the lobes are of large size and in the form of depressed, ovoid, and shiny black cups (fig. 12).

Elattoneura coomansi, sp. n. (fig. 13).

Material studied: — W. Borneo: 2 ♂ Pontianak, Mt. Ambawang, March 13, 1931; 3 ♂, 4 ♀, Singkawang, forest-marsh near Bakoean, July 20, 1932; all L. Coomans de Ruiter leg. — Banka I.: 2 ♂, between Pangkal Mundoe and Aer Pandan, Sept.-Oct., 1929; 6 ♂, Pangkal Mundoe, Oct. 1929 & Sept. 10, 1931, J. van der Vecht leg. — Billiton I. (SW): 1 ♂, 3 ♀, Kepang, April 13, and 1 ♂ (W), Seroe, June 16, 1936, F. J. Kuiper leg.

Male (ad.). — Head coal-black, lustreless, except the labrum which is rather shiny; labium dark flesh-coloured, tipped with black. Pro- and synthorax also dull black without any pale markings except the poststernum, which is slightly paler (purplish brown). Thoracic sides, coxae and underparts pruinose blue.

Legs black, tarsal claws brown. Wings uncoloured but membrane tinged with greyish-brown in aged individuals. Pterostigma brownish-black, surrounded by a fine pale line; lozenge-shaped, with the distal side rather convex. Nodal index $\frac{14-17}{13-15}$.

Abdomen very slender, unicolorous black, with faintiest indication of dark brown spots alongside of segm. 2 and at extreme base of 3; subterminal rings obsolete in sub-adult specimens and sides of segm. 1 pruinose in aged individuals. Last three intersegmental rings possibly green or blue in life.

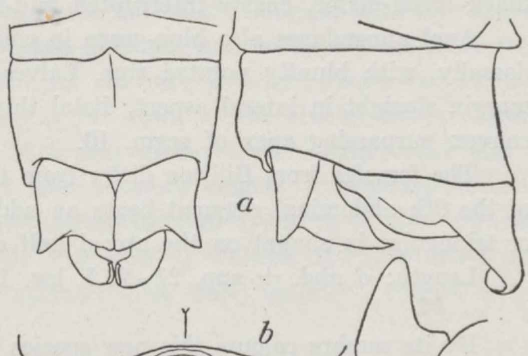

Fig. 13. *Elattoneura coomansi*, sp. n. W. Borneo. *a*, male anal apps., dorsal view and right side; *b*, female posterior lobe of prothorax, dorsal view and *c*, the same, right side.

Anal appendages: superior pair blackish-brown; inferiors dirty yellow-brown, tips black (fig. 13a). The inferior tooth-like projection of the upper pair of appendages very large, its lower margin often concealed (not so in our drawing).

Female (ad.). — Labium brownish-yellow, tips of side-lobes darkened. Labrum, genae, base of mandibles and anteclypeus yellow-brown, the labrum with a dark mid-basal impression. Head otherwise black, with an indistinct

brownish stripe between the antennae, crossing the anterior ocellus. Basal joints of antennae brown.

Prothorax bronzy-black with a large, pale brown spot on the middle portion and with the side-edges of the posterior lobe also pale. Posterior lobe deeply excised on middle, forming two lobes, the lateral portions of which are rounded and depressed, the inner ones bending straight upwards and somewhat inwards and forwards, in such a way as to nearly meet one another in the median line; the tips are bluntly pointed (fig. 13b-c).

Synthorax dull bronzy-black as far down as the first lateral suture; mesepimerites with slight dark metallic-green shine. Sides purplish flesh-coloured, with the metinfraepisternites mainly black and with an isolated, bronzy-green stripe on middle of the metepimerum. Dorsal end of second suture and lower edge of metepimerum also with a dark spot. Ventral surfaces and coxae flesh-coloured, thinly pruinescent.

Legs pale brown, apices of femora and spines dark brown.

Wing-membrane smoky, especially along the nervures. Pterostigma rather higher than in the male, blackish-brown.

Abdomen dark brown above, or wholly black, paler along the sides; segm. 3 - 6 with blackish-brown apical rings and with very small, paired, basal yellow annules on segm. 3 - 7 (often indistinct or absent altogether). Segm. 8 and 9 black, tergites of each with a thick, greenish-yellow stripe along lower margin, that on 9 being widest. Segm. 10 obscure blue (or green?), save for a narrow, black basal stripe, nearly interrupted mid-dorsally.

Anal appendages also blue-green in colour, triangular in outline, flattened dorsally, with bluntly pointed tips. Valves brown, basal two-thirds of lower margin straight in lateral aspect, distal third widened, with the lower margin convex, surpassing apex of segm. 10.

The females from Billiton differ from those of Borneo in that the dorsum of the 9th abdominal segment bears an additional bluish-green spot (roundish or triangular in shape) on the apical half of the segment.

Length: ♂ abd. + app. 27 - 29.5, hw. 18 - 19; ♀ 28 - 30, 20 - 21 mm.

By its sombre colours this new species comes nearest to *E. tetrica* (Laid.) and *E. nigerrima* (Laid.), from Peninsular India, but it differs from both by the black face, lacking bluish spots entirely, and by the armature of the female prothorax and male appendages.

I have named it in honour of Mr. L. Coomans de Ruiter, who discovered so many new species in Western Borneo.

Elattoneura aurantiaca (Selys) (fig. 14).

1886. Selys, Revis. Syn. Agrion. p. 161 (key), 169 - 170 sep. — ♂♀ Sarawak (*Disparoneura*).

1913. Laidlaw, Proc. Zool. Soc. London, p. 76 (note) (*Disparoneura*).

1936. Cowley, Ann. Mag. Nat. Hist. (10) 17, p. 518, 523 (synonymy).

Material studied: — S. Sumatra: 2 ♂, Lampong Res., Terbanggi-hilir near Menggala, Aug. 14, 1936, MAX BARTELS leg. — W. Borneo: 4 ♂, Pontianak, Peniti River, Febr. 24, 1931; 10 ♂, 2 ♀, Singkawang, forest-marsh near Bakoean, Febr. 17 and July 19 - 20, 1932; 1 ♂, idem, Tjapkala Rd., April 4, 1932; all L. COOMANS DE RUITER leg. — Banka I.: 1 ♂, Kali Mundoe, Sept. 10, 1931, J. VAN DER VECHT leg. — Billiton I.: 10 ♂, Tjeroetjoek, Aug., Sept. and Dec. 1935, April and Sept. 1936; 3 ♂, Roewah, Sept. 17, 1935; 1 ♂, Tandjong Pandan, July 22, 1936; all F. J. KUIPER leg.

This species, which is apparently rather a common insect where found, has not been recorded from anywhere since the original description was published some fifty years ago. Some descriptive notes are here given in addition to those already given by SELYS.

Male (ad.). — Labium yellowish; genae, labrum and anteclypeus pale creamy-yellow with slight greenish intermingling; labrum with a dark basal impression. Postclypeus and frons Pompejan-red (RIDGWAY), the latter with a bronzy-black patch between the base of antennae and the eye-margin, and an indefinite, dark, transverse line between the antennae. A transverse, Pompejan-red band connecting the eyes and crossing the vertex, where it is widest. Occipital lobes, occiput and rear of the head dark bronzy-green, slightly pruinose-blue underneath. Basal joints of antennae yellow-brown, remainder black.

Prothorax Jasper-red above, with the sutures only black; sides pale, pruinose.

Dorsum of synthorax (inclusive of the ante-alar triangles) with a complete, median longitudinal band, bronzy-green in colour and occupying the inner two-thirds of each mesepisternite, which, for the rest, is bright Jasper-red in fully coloured specimens. Thoracic sides, as far down as the second lateral suture, Jasper-red, with rudiments only of bronzy-green stripes along upper end of the three sutures, that along first lateral suture longest. Mesinfraepisternites, lower portion of mesepimerum and metepisternum (ventral to the spiracle), and most of the metepimerum pale yellowish or whitish, thinly overled with light blue pruinescence. Ventral surfaces also pale, slightly pruinose-white. Coxae pale, pruinose exteriorly.

Legs pale yellow; femora with indistinct sub-apical rings and with the apices also brown. Tibiae and tarsi unmarked.

Wings hyaline, or slightly tinged with brown along the nervures. Pterostigma almost square, very slightly widened distally. Nodal index $\frac{13-15}{11-12}$.

Abdomen shaped and coloured as given in the original description. Articulation between segm. 1 - 2 finely black and sides of these segments usually pruinose-white.

Anal appendages dirty orangish, superior pair usually brownish above, and apex of inferior tooth also darkened; shape as described in the original diagnosis (fig. 14).

Female (ad.). — Differs from the male in that the mouthparts are pale bluish-green, the band between the eyes being wider and coloured yellow anteriorly and pale blue posteriorly. The bronze-green band on the dorsum of the thorax is joined on either side by a rusty-brown stripe, which is ill-limited laterally and merges into the fleshy or creamy-yellow colour of the sides.

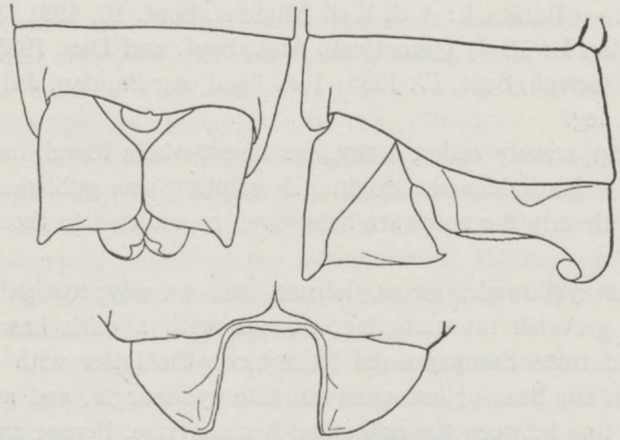

Fig. 14. *Elattoneura aurantiaca* (SELYS), W. Borneo. Male anal apps., dorsal view and right side; bottom: posterior lobe of ♀ prothorax, dorsal view.

Prothorax wholly pale in colour; shape of posterior lobe as described by DE SELYS, the two lobes subtriangular in outline and rather concave dorsally but only slightly elevated (not "fortement redressées"!) (fig. 14).

Abdomen light brown, darker posteriorly. Ante-apical pale spots of segm. 3 - 6 less distinct than the fine, white, basal annules; apical rings dark brown. Segm. 8 - 10 lighter to darker brown. Valves slender and straight, pale brown in colour, apical portion slightly convex below; tips of valves not projecting beyond the tuberculum.

Size variable: ♂ abd. + app. 29.5 - 35, hw. 17.5 - 21; ♀ 30 - 32, 19 - 19.5 mm.

Descriptions of two new species of *Prodasineura* COWLEY.

Pending a revision of the genus *Prodasineura* (*Caconeura* olim), for which an examination of a number of types and of more material from other regions seems very needed, I am able in the following to supply in advance the diagnoses of two new species from W. Borneo, thanks to the rich amount of material sent to me for some years by Mr. L. COOMANS DE RUITER. Although I believe them to be well characterized and readily recognizable species, I hope to publish a more detailed account of them later; in addition to the descriptions and for comparison with the terminal abdominal appendages of other species of the genus, I figure outline drawings of the same parts of the males described hereafter as new, but detailed sketches of the female prothoracic organs will be supplied later.

Prodasineura tenebricosa, sp. n. (fig. 15).

Material studied: — 3 ♂ (ad.), W. Borneo, Singkawang, forest-brook near Bengkajang, Oct. 11 - 28, 1932 and June 15, 1933; 1 ♂ (ad.), same loc., Piong San River, Dec. 8, 1931; 4 ♀ (one juv.), same loc., Raja River near Montrado, Oct. 22, 1931. All L. COOMANS DE RUITER leg. Holotype ♂ Bengkajang, June 15, 1933, allotype ♀ Raja River, Oct. 22, 1931.

Male (ad.). — Squamae of labium yellowish. Head otherwise entirely black, save for a minute reddish spot on either side between the posterior ocellus and the antenna. Mouth-parts, genae and frons shiny.

Pro- and synthorax throughout deep black without any pale markings other than a short, pale yellow ventral stripe joining the spiracle of the thoracic sides, a very fine whitish line along middle of the second lateral suture, and a similar, slightly broader, whitish stripe along lower margin of metepimerum. There is also a white point below the sinuses of the hind wings on top of the second suture. Venter of thorax clear greenish-white, with a broad, black longitudinal band on each side along margin.

Legs black; whitish marks about the articulations of coxae and trochanters, and a white ring round the base of the femora; all tibiae creamy-white exteriorly. Tarsal claws distinctly toothed apically.

Wings very narrow, hyaline. Superior sector of the triangle in front wing reaching posterior margin of the wing slightly before the middle of or to the very end of the first cell following the quadrilateral, in the hind wing ending at or slightly before the subnodus; inferior sector of the triangle absent. Postnodals $\frac{14-15}{12-13}$. Pterostigma rather oblique and about one and one half times longer than wide, very slightly widened apically, covering slightly more than one underlying cell; deep black.

Abdomen long and excessively slender; shining black. Segm. 1 with a dull yellow side-spot, the lower margin and the transverse articulation between 1 and 2 also pale. Segm. 2 entirely black, save for a sharply delimited fine white line along lower margin. Each of the segments 3 - 7 has no other marks than an extremely narrow (though sharply defined) white dorso-lateral basal ring, incomplete below. Remaining segments and anal appendages deep black. Appendages shaped as in fig. 15.

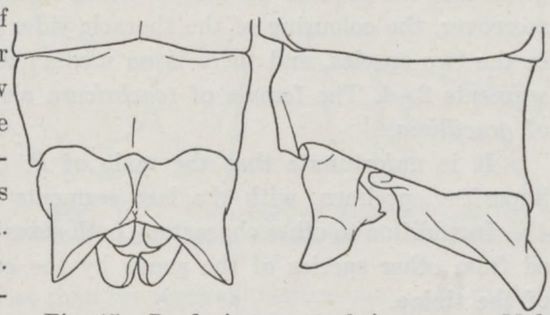

Fig. 15. ***Prodasineura tenebricosa*, sp. n. Male anal apps., dorsal view and right side.**

Female (ad.) — Labium yellowish-white, the lateral lobes black. Anterior surface of head shining black; mandible-bases with a triangular whitish spot, separated from a white point on the extreme base, next to each gena. Head otherwise coloured as in male, the reddish spot between posterior ocellus and antenna larger, rather triangular in outline and clearly defined.

Prothorax entirely black; posterior lobe perpendicularly raised, middle portion low and straight-margined, the lateral edges produced on either side into triangular, ear-like lobes, broad at base, placed in the transverse axis of the body and directed straight upwards.

Synthorax deep black; yellowish-white side-markings similar in principle to

the male but slightly enlarged: the fine line along second suture does not extend entirely upwards but ventrally coalesces with the pale band along lower margin of metepimerum, which is a little broader than in the opposite sex, though not extending upwards for the entire length. Venter of thorax palest greenish-white, the black longitudinal band on either side of the middle obsolete.

Legs as in male, basal fourth of the inner surfaces of posterior femora with an additional yellow stripe, widest basally.

Wings hyaline, neuration not different from the male. Pterostigma very dark brown.

Abdomen long and slim, throughout shining black. Segm. 1 with the sternite and a spot on the side dull yellow; 2 as in male and with a vestige of a pale postero-lateral spot. Whitish basal lunules of segm. 3 - 7 also similar though obscured. Segm. 8 - 10 and appendages deep black, 8 and 9 each with a sharply defined bluish-white stripe along lower margin of the tergite, that on 9 widest. There is a fine, pale line along the posterior border of segm. 9 and 10, while the last segment bears a strong median longitudinal keel. Anal appendages vestigial, black. Valves short and slender, not surpassing the end of abdomen but distinctly projecting ventrally along with the 8th sternite, whose ventral margin, in profile view, is in line with that of the valves.

Length: ♂ abd. + app. 31.5 - 32, hw. 19 - 20; ♀ 32 - 33, 20 mm.

This species evidently comes nearest to *P. gracillima* (SELYS), doubtfully recorded from Celebes (or Borneo?), but it differs from that species by the genae and the base of the labrum being shining black instead of pale-coloured; moreover, the colouring of the thoracic sides and abdomen is entirely different in the two species, and there is no median longitudinal line on the abdominal segments 2 - 4. The female of *tenebricosa* also does not fit SELYS's description of *gracillima*.

It is unfortunate that the male of *P. gracillima* was described from an imperfect specimen, with the last segments of abdomen missing.

In addition to other characters, both sexes of *tenebricosa* may be distinguished from other species of the genus by the conspicuously white outer surfaces of the tibiae.

Prodasineura haematosoma, sp. n. (fig. 16).

Material studied: — 17 ♂, 7 ♀, W. Borneo, Singkawang, forest-brook near Bengkajang, April to December, 1932, June and December, 1933; 3 ♂, 1 ♀, same loc., near Oedoek, Dec. 12, 1931; 1 ♂, same loc., near Penaring, March 18, 1932. All L. COOMANS DE RUITER leg. Holo- and allotype Bengkajang, June 15 and Oct. 13, 1933.

Male (ad.). — Head entirely black above and below, save for a fine yellowish line on base of labium; face glossy black. Prothorax entirely black. Synthorax deep black with slight bronzy reflections above; a narrow yellow metepisternal stripe across the spiracle: either straight, complete and fairly

broad (semiad., Penaring), or widest below, tapering dorsally and extending for about two-thirds of its length from the anterior margin. Lower border of metinfraepisternites and metepimerum with a yellow margin, widening dorsally to form a triangular marking filling up the postero-dorsal edge of the metepimerum. Ventrally the thorax is yellow, save for two sharply defined black bands, incomplete anteriorly, on either side of the middle.

Legs black; coxae marked with yellow apically, trochanters yellow, black at the articulations. First two pairs of femora with a yellow ring at base, posterior femora with the basal half of the inner surfaces also yellow; posterior two pairs of tibiae striped with yellow exteriorly. Tarsal claws distinctly toothed.

Wings narrow, hyaline or slightly tinged. Superior sector of the triangle in front wing ending one cell proximal to, at the level of, or half a cell distal to the subnodus, in the hind wing ending at one cell proximal to, at the level of, or to slightly beyond the subnodus; inferior sector of the triangle absent. Postnodals $\frac{13-15}{11-12}$. Pterostigma normal, covering one cell, black.

Abdomen deep black, marked with carmine above, as follows: segm. 1 black, except a triangular yellow side-spot along hind margin; 2 with a longitudinal carmine spot, occupying the anterior three-fourths of the dorsum, almost touching anterior margin but suddenly tapering posteriorly and ending in a fine point; occasionally the apex of this spot is prolonged backwards and attached to the posterior margin of the segment. Dorsum of segm. 3 - 6 with carmine bands, running nearly the whole length of segment, the apical eighth or ninth of these segments bearing sharply defined, deep black rings. Segm. 7 - 10 black.

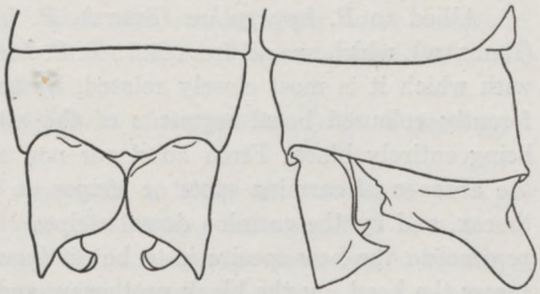

Fig. 16. *Prodasineura haematosoma*, sp. n. Male anal apps., dorsal view and right side.

Anal appendages shaped as in fig. 16. Superior pair clear yellow, the ventro-apical teeth black; interior tooth-like projection smaller than the terminal ventral tooth and directed obliquely inward (not visible in dorsal view). Inferior appendages reddish-brown, apices incurved, black.

Female (ad.). — Differs considerably from the male.

Labium as in the opposite sex; labrum, mandible-bases and a mesial spot on the genae clear yellow, the labrum with a round black mid-basal impression and with the margin also black. Head otherwise black, with a very fine but complete pale orange line connecting the eyes across anterior ocellus, just behind the antennae; this stripe occasionally a little widened on both sides. Antennae dark brown. Rear of the head black.

Prothorax black with three pale orange dots on each of the lobes, the anterior two confluent. Posterior lobe erect, hind margin produced on either

side so as to form a bluntly pointed, horn-like projection, flattened in the transverse plane, directed upwards and then forwards.

Synthorax black with narrow, almost straight, pale orange antehumeral stripes, which are evenly narrowed upwards, tapering to a fine point, ceasing at about 1½ to ½ mm before the ante-alar triangles. These black, each with a fine, orange, transverse spot on middle.

Thoracic sides deep black, each with a complete, well defined yellow metepisternal band along first suture, including the spiracle. Metepimerum also yellow posteriorly, the metinfraepisternites for the greater part black. Under surfaces clear yellow, marked with black as in the male.

Legs yellowish but all femora striped with black exteriorly, and anterior tibiae also with a black line.

Wings clear, neuration as in male. Pterostigma pale greyish-brown.

Abdomen slender, dull sepia-brown, paler beneath. Dorsum of segm. 1 dark brown, with a yellow side-spot; 2 also darkened above, with indistinct pale median line. Base of 3 with distinct though small yellow twin-spot, and 4 - 6 also with an indication of minute basal and subterminal pale spots. Last four segments not or scarcely darkened, uniform brown. Valves small and but slightly projecting ventrally, tips not surpassing anal appendages.

Length: ♂ abd. + app. 29 - 31, 16.5 - 18; ♀ 28.5 - 32, 17 - 19 mm.

Allied to *P. hyperythra* (SELYS), *P. hosei* (LAIDLAW) and *P. peramoena* (LAIDLAW), which are all from Borneo. *P. haematosoma* differs from *hyperythra*, with which it is most closely related, by the shiny black labrum, by the differently coloured basal segments of the abdomen, and by the segments 7 - 8 being entirely black. From *hosei* our new species differs by the black genae, the absence of carmine spots or stripes on the prothorax and dorsum of synthorax, and by the carmine dorsal stripes on segments 4 - 6 of abdomen. From *peramoena* the new species is to be distinguished by the absence of a red line across the head, by the black prothorax, and by the presence of carmine dorsal stripes on segments 4 - 6 of abdomen.

Fam. AGRIONIDAE.

Pseudagrion coomansi, sp. n. (figs. 17 and 18d).

1916. RIS, Supplem. Entom. no. 5, p. 41 fig. 17 (apps. ♂), 42. — ♂ Sintang, W. Borneo (*microcephalum*).

Material studied: — N.E. Banka I.: 1 ♂ (ad.), Pangkalpinang, Nov. 1, 1929, J. VAN DER VECHT leg. — Billiton I.: 30 ♂, 8 ♀ (ad.), distributed all over the island and fairly common, F. J. KUIPER leg. — W. Borneo: 3 ♂ Singkawang, Bengkajang Rd., Nov. 16, 1931; 12 ♂, 1 ♀, same loc., Patengahan Rd., Dec. 1931, Febr. 18, July 19 - 20, 1932, and Jan.-Febr. 1933; 2 ♂, same loc., Montrado, Oct. 22, 1931. All L. COOMANS DE RUITER leg. Holotype ♂ Montrado, Oct. 22, 1931, allotype ♀ Patengahan, Febr. 18, 1932.

Male (ad.). — Labium pale yellow. Anterior surface of head, as far upwards as level of anterior ocellus, apple-green, unmarked, save for a black basal point on the labrum, and three more or less confluent black spots on postclypeus. First joint of antennae blue, the remainder black. A transverse, bronzy-black fascia across the ocelli connecting the eyes. This transverse band is irregularly delimited anteriorly, projecting somewhat anterad between median ocellus and each of the antennae; there is besides, a black, rather crescent-shaped point on the middle of frons, situated between the base of antennae. Rearward, the black cross-band continues on each side along the margin of compound eye, enclosing large, sky-blue (? green) postocular spots, which are just separated from a transverse green bar at occipital margin. Rear of the head black, slightly pruinose, with a broad greenish stripe along the eye-margin.

Prothorax black above, blue along sides; dorsum with a large, rectangular blue spot in the centre, which is divided mesially by a narrow, longitudinal, black line, and with a blue point on each side. Anterior and posterior lobes likewise blue.

Synthorax striped with black as appears from fig. 18d. Antehumeral bands broad, slightly indented by black dorsally. Sides with a conspicuous black dot between ante-alar border and the spiracle, and with a crescent-shaped spot at dorsal end of second suture. Venter and coxae pale bluish-green or rather yellowish or ochreous, both slightly powdered with blue.

Legs green, femora with a thick black stripe along their outer sides and with the knees also black; tibiae and tarsi ochreous, the last tarsal joint and claws darkened apically. Spines blackish.

Wings clear or tinged with greyish-brown. Postnodals $\frac{10-11}{8-9}$. Pterostigma diamond-shaped, dark sepia-brown.

Abdomen slenderer and apical segments a little more widened than in *microcephalum,* but less so than in *nigrofasciatum.* Blue, marked with black on dorsum, as follows: — segm. 1 with a black spot at base. Segm. 2 with a broad, rectangular, black marking occupying the entire dorsum, except posteriorly, where it is suddenly constricted and connected with the posterior margin by a tiny, short stalk; near its base this black spot encloses a distinct central spot of blue. This anterior blue spot varies greatly in size and form: in the majority of specimens it is rectangular in outline but in others it is reduced to an oval spot. In others still, the black dorsal mark is rather narrowed anteriorly and in the form of a fork-like structure, the prongs of which do not extend as far as the base of segment.

Dorsum of segm. 3 - 6 with complete, longitudinal, bronzy-black bands, growing wider from before backwards and touching the anterior margin of segments; on segm. 3 it is gradually narrowed anteriorly but not pointed. On the base of each of these segments there are thus only small blue spots interrupted by the median line. Segm. 7 entirely black dorsally; 8 - 9 sky-blue, each with a thick black ring along posterior margin. Dorsum of 10 black, sides blue.

Superior anal appendages of same length as segm. 10, black in colour, with the lower branch blue interiorly. Inferior apps. pale ochreous, shaped as in fig. 17.

Female. — Differs from the male in many respects, as does the ♀ of *microcephalum* and allied species. Head pale olivaceous suffused with brownish-orange on the labrum and postclypeus; genae pale yellow. No black lines or spots on the vertex, which is of an uniform olivish tint, and no dark stripes surrounding the postocular spots, which are shaped similarly to the male, though coloured green or dark bluish-olive instead of blue. Rear of the head black on inner half, pale yellow along eye-margin.

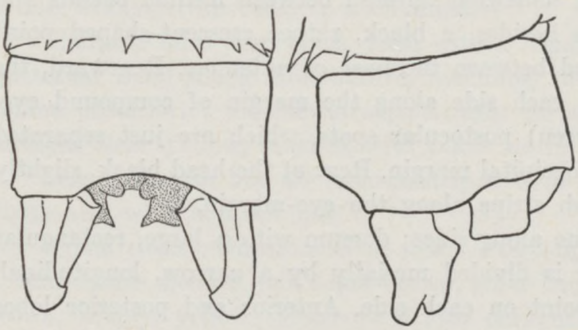

Fig. 17. *Pseudagrion coomansi*, sp. n. W. Borneo. Male anal apps., dorsal view and right side.

Prothorax greyish-olive with the sutures only black; processes slender, yellowish, shaped much as in *microcephalum.*

Synthorax pale greyish-olive with very faint bluish-green intermingling; median and humeral stripes ill limited, pale rusty-brown; ventral and dorsal ends of median carina with black points (occasionally the entire mid-dorsal carina black), and a fine black stripe on dorsal ends of humeral and second lateral suture. Venter of thorax pale, often pruinose.

Coxae pale greenish, pruinose-white in adult specimens. Legs uniform pale ochreous, the spines and a short black streak on outer half of femora black.

Wings as in male, neuration pale. Pterostigma greyish-yellow.

Abdomen yellowish- to olive-green. Dorsal bronzy-black markings similar to the male though considerably narrower, progressively broader from before backwards but the pale ground-colour of segm. 1 - 6 well visible from above. Segm. 2 with the dorsal band very narrow, attached to the base of segment, with a diamond-shaped subterminal widening and finally again narrowed (not touching apex of segment in the allotype). Dorsum of 7 - 9 bronzy-black, these markings on 7 slightly constricted posteriorly, narrowed and not touching apex of segment on 9; 10 unmarked, deeply and narrowly notched at apex.

Anal appendages small, shorter than segm. 10, unmarked.

Length: ♂ abd. + app. 26.5 - 27, hind wing 16 (Borneo); 28, 17 (Banka); 26 - 30, 16 - 19 mm (Billiton); ♀ 28, 18.5 (allotype), 24.5 - 29, 17 - 19 (Billiton).

This species is obviously closely related to *P. nigrofasciatum* LIEFT., from Java, though slenderer and of smaller size. Of the former I have examined a good series of specimens, collected by Mr. H. OVERBECK, who says that it is a common species near Djokjakarta (Mid Java), but I have not seen it from

elsewhere except from the type-locality and from Klakah in East Java (type of *infracavum* SCHMIDT).

Both species agree in having the dorsal marking of segm. 2 of abdomen complete and touching both ends of the segment. Besides, in both of them, the lower margin of the superior appendage is distinctly outbent in profile-view, the inferior one being truncated apically. In the original description of *P. nigrofasciatum* the thoracic sides of the male were stated to bear a black band but this was in error. (See SCHMIDT, Arch. Hydrobiol. Suppl. 13, 1934, p. 349-350 and LIEFTINCK, Revue Suisse Zool., 43, 1936, p. 124, footnote).

P. coomansi differs in a number of slight but apparently very constant characters from *P. nigrofasciatum,* which are best tabulated as follows:—

P. nigrofasciatum.	*P. coomansi.*
Stature robust; apical segments of abdomen strongly widened.	Stature slender; apical segments of abdomen only slightly widened, similar in form to *microcephalum.*
No black dot upon first lateral thoracic suture (a mere point is occasionally visible, as is the case in *microcephalum*).	A conspicuous, oval, black dot along first lateral thoracic suture, placed about half-way down between upper margin and the spiracle.
Segm. 2 of abdomen with a bronzy-black dorsal mark, widest posteriorly, which, after a well-marked constriction, is broadly attached to both ends of the segment (see fig. 48d, SCHMIDT, loc. cit.).	Segm. 2 of abdomen with a bronzy-black dorsal mark, slightly narrowed anteriorly, which is connected with the posterior margin by a fine short stalk; it meets the anterior margin on each side of the middle so as to enclose a rectangular or oval median spot; occasionally, this blue spot coalesces on either side at base with the colour of the sides.
Black terminal rings of segm. 8 and 9 mere lines.	Black terminal rings of segm. 8 and 9 very conspicuous.
Segm. 10 of abdomen almost three times broader than long. Sup. anal apps. with the dorsal margin straight in profile view, the branches equal in length; interior shelf-like projection in dorsal view with a rounded sub-basal dilatation followed anteriorly by a slight concavity, the basal tooth-like projection situated at extreme base,	Segm. 10 of abdomen not fully two and one-half times broader than long. Sup. anal apps. with the dorsal margin distinctly concave in profile view and with the upper branch a little longer than the lower one; interior shelf-like projection in dorsal view evenly widened basally, with its mesial border straight and terminating into an acute-

curved a little dorsad and only visible in oblique postero-dorsal view (see: fig. 2, LIEFTINCK, loc. cit., and fig. 49, SCHMIDT, loc. cit.). angulate or tooth-like projection, which is placed further distad and hence is always plainly visible in dorsal view (fig. 17).

The specimens from Billiton I. do not differ much from typical examples of W. Borneo. They are an average larger and the black spots on the labrum and the postclypeus may be reduced or absent; on the other hand, in a few specimens the median portion of the transverse black band between the eyes extends anteriorly to a level between clypeal suture and anterior ocellus, thus assimilating the crescent-shaped median spot.

P. coomansi in some respects resembles also *P. microcephalum* and may be mistaken for it. In W. Borneo as well as in Billiton, these two species fly together and are equally common, at least in certain localities in Billiton. *P. coomansi* is easily distinguished from it by its slender forms, the conspicuous black spot on the thoracic side, the blue-framed black band on dorsum of segm. 2 of abdomen, and by the widely different appendages.

A single ♂ from Sintang, W. Borneo, described and figured by RIS (loc. cit.) as *microcephalum*, almost certainly belongs to *P. coomansi*. The sketch of the appendages of this male strongly suggests *coomansi*, as does the description of the peculiar shape of the dorsal spot on segment 2 of abdomen: "eine extreme Form der Zeichnung zeigt das ♂ von Sintang, ein Rechteck von drei Viertel der Segmentlänge mit schmalem terminalem Stiel und blauem Punkt in der Mitte." (loc. cit. p. 42).

The number of blue-and-black *Pseudagrion* is steadily increasing with a better knowledge of the Malaysian fauna, and the discrimination of the many Oriental species is growing difficult.

Pseudagrion celebense, sp. n. (figs. 18c and 19).

1916. RIS, Suppl. Entom. 5, p. 40 - 42 fig. 18 (apps. ♂). — ♂♀ Paloe and Takala Mts., N. & S. Celebes (*microcephalum*).

Material studied: — N.W. Celebes: 3 ♂ (ad.), Paloe, Jan. 1937, AWIBOWO leg. Central E. Celebes: 1 ♂ (imperfect), 1 ♀ (ad.), Kali Tominanga, Aug. 22, 1932, Prof. Dr. R. WOLTERECK leg. — N. Halmahera I. (Northern Moluccas): 3 ♂ (ad.), Tobelo, June-July, 1931 and April 1933, M. J. VAN DIEJEN leg. Holotype ♂ Paloe, Jan. 1937; allotype ♀ Tominanga, Aug. 22, 1932.

Stature of *P. calosomum* LIEFT. and *australasiae* SELYS, but nearest to *schmidtianum* LIEFT. and *pelecotomum* LIEFT.

Male (ad.) — Deep blue and black. Labium whitish. Anterior surface of head, as far upwards as level of anterior ocellus, pure azure-blue, without any dark markings. First antennal joint blue, remainder black. A transverse black fascia across the ocelli connecting the eyes, slightly irregularly delimited in front as well as posteriorly. Postocular spots large, azure-blue, touching the eye-margin laterally in one point. Occiput with a transverse, whether or not

isolated, blue median stripe. Rear of the head black, slightly pruinose, with a blue stripe along the eye-margin.

Prothorax blue; dorsum, the anterior lobe excepted, black with a squarish mid-dorsal blue twin-spot and a circular spot on either side of this; the posterior lobe also finely bordered with blue.

Synthorax azure-blue, marked as in fig. 18c, the median and humeral black stripes rather broad.

Coxae and legs blue, all femora with their outer sides sharply defined deep black; tibiae and tarsi yellow, the tarsal joints black apically. Spines black.

Wings hyaline, pterostigma pale brownish, very oblique but with parallel sides, almost twice longer than deep. Postnodals $\frac{11-12}{9-10}$.

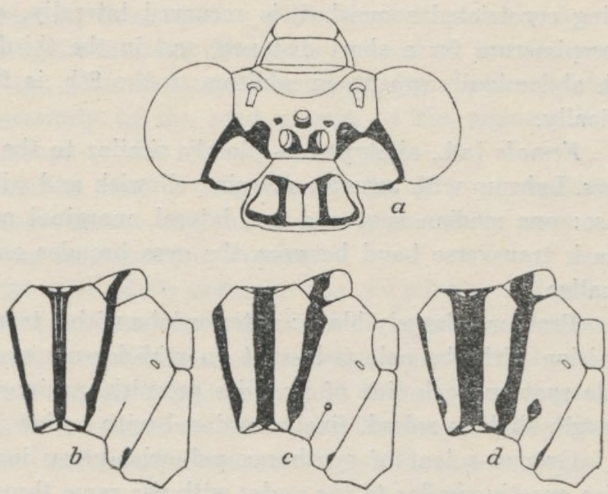

Fig. 18. Dorsal view of head of ♂ *Pseudagrion papuense* TILL. (Queensland, *a*), and diagrams of thoracic colour-pattern of ♂ *P. papuense* TILL. (*b*), *P. celebense*, sp. n. (*c*), and *P. coomansi*, sp. n. (*d*).

Abdomen azure-blue and black; terminal segments but slightly widened in lateral dimension. Segm. 1 with a transverse dorsal basal spot, its posterior margin finely black laterally; 2 blue with a small, definitely triangular, dorsal subapical black spot not extending anterad beyond the middle of segment and connected to a narrow apical annule by a short linear stalk. Segm. 3 - 5 with moderately broad dorsal bands pointed anteriorly and connected with the posterior rings of preceding segments, expanding sub-apically and then contracting again to join narrow apical annules; 6 - 7 similar but expanding continuously as far as apex of segment; 8 - 10 azure blue, 8 with extremely narrow black apical annule and 10 with a tiny X-shaped marking covering little of the dorsum. Segm. 10 very short.

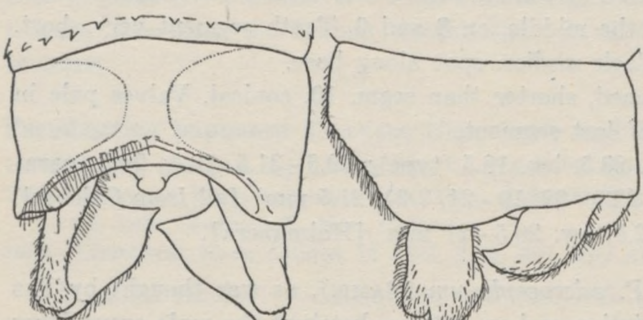

Fig. 19. *Pseudagrion celebense*, sp. n. Paloe (type). Male anal apps., dorsal view and right side.

Anal appendages very short, black, shaped as in fig. 19. Superiors with the interior shelf-like projection enormous in size, concave dorsally and much

widening basally, terminating into a pointed end-hook, which is directed mesiad; the median portion of this interior projection bears a large, yellowish spot. Inferior apps. yellow, in ventral view with the basal half toothed interiorly, the apical portion upcurved and strongly pointed.

In one of the paratypes the dorsal end of the black humeral fascia, after being constricted somewhat, is recurved laterally, entering with its apex the mesepimerum for a short distance, and in the third specimen from Paloe the 9th abdominal segment, in addition to the 8th, is finely margined with black apically.

Female (ad., allotype). — Closely similar to the male but differing as follows. Labrum with anterior margin yellowish and with three black points along base: one median spot and two lateral, marginal ones. Postclypeus darkened. Black transverse band between the eyes broader and postocular spots a little smaller.

Prothorax largely black: anterior lobe with a transverse green stripe, median division with the pale twin-spot on mid-dorsum smaller, and with a roundish pale spot on each side of it; sides greenish, pruinose; posterior lobe black, its margin slightly raised, finely bordered with yellow, the horns extremely short.

Ground-colour of synthorax yellowish-green instead of azure-blue; otherwise *exactly similar to the male:* with the same three black stripes; sides rather more yellow than green. Venter pale, pruinose-white.

Legs as in male, femora with black markings less in evidence (narrowed basally) but also extending along their full length. Wings as in male.

Abdomen dark greenish (discoloured). Black markings wider than in the male but very similar in principle, progressively broader from base to apex. The black longitudinal mark on segm. 2 extending its whole length, triangularly widened before the apex but continued basad as a narrow median stripe. Segm. 8 - 10 apparently pale-coloured (green ?), with traces of two subterminal black points, one on each side of the middle, on 8 and 9. Tenth segment very short, bluish, with a triangular black median spot along base.

Anal appendages darkened, shorter than segm. 10, conical. Valves pale in colour, not reaching apex of last segment.

Length: ♂ abd. + app. 28.5, hw. 18.5 (type); 29.5 - 31.5, 19.5 - 20.5 (paratypes); ♀ 31, 22 mm. (RIS: ♂ 30 - 32, 19 - 21, ♀ 31, 21.5 mm) [all from Celebes].
♂ abd. + app. 31.5 - 32.5, hw. 20.5 - 21 mm. [Halmahera].

This is decidedly not *P. microcephalum* (RAMB.), as was thought by RIS (loc. cit.), who gave a description and an outline-sketch of the male appendages after specimens given to him by Dr. L. MARTIN and collected in the same locality whence our typical series came.

The ♂ of *P. celebense* is abundantly differentiated from *microcephalum* by its more robust build and the enormous development of the interior division of the upper appendage, with its single basal tooth, which will serve to its easy recognition. When seen from aside, the superior pair of appendages is

but slightly notched apically, and the upper branch is much the smaller and at the same time shorter than the lower one; the inferior appendages also differ very markedly from those of *microcephalum:* they are curved upwards and taper gradually to a fine apical point, thus resembling those of *P. schmidtianum* LIEFT. (Timor), *pelecotomum* LIEFT. (New Guinea) and *papuense* TILLYARD (S. New Guinea and Queensland), three species with which it possibly forms a rather natural group, distinguished from other blue species of the Oriental region by the shortness of the 10th abdominal segment, the declivous blue sub-anal plate (situated posteriorly to the hind margin of the segment and the anal wall), and by the shape of the inferior appendages.

The ♀ of *celebense* resembles that of *australasiae* SELYS (= *bengalense* LAID.), which, so far as I know, is the only other species known to occur in the Malay Archipelago having isochromatic females.

This is in full accordance with RIS's notes on the s u p p o s e d ♀ polymorphism of *"microcephalum"* (sens. lat.); on page 43 of his paper, he remarks:

b) Bei einigen Exemplaren erscheint eine vollständige aber unregelmässig buchtige schwarze Linie auf der Schulternaht und Teile feiner schwarzer Linien, die jederseits in geringem Abstande die Mediannaht begleiten (das eine ♀ von Palu [and from] Gladstone)". — These are possibly *microcephalum.*

c) Eine fast völlig andromorphe Form mit schwarzer Zeichnung auf der Dorsalseite des Kopfes fast wie beim ♂, breiter schwarzer Binde auf der Mediannaht des Thoraxdorsum, schwarzer Linie auf der Schulternaht (Ceylon-BUGNION [probably *australasiae* or an allied species], und das zweite ♀ von Palu) [certainly *celebense*].

The true *P. microcephalum* occurs also in Celebes and differs but slightly from the western (Malaysian) type. I possess a quite typical ♂ from Mapangat, near Menado (N. Celebes), a ♀ from Makassar (S. Celebes), and lastly, I identified a pair from the Lompo Batang Mts., in S. Celebes, for the Hamburg Museum.

Pseudagrion papuense TILLYARD (figs. 18a-b and 20).

1876. SELYS, Synopsis Agrion., p. 506. — ♂ and ?♀, Queensland (*australasiae*, pars).
1926. TILLYARD, Rec. Australian Mus. 15, p. 159 - 160. fig. 1 - 2 (apps. ♂ and body). — ♂♀ Lake Murray, S. New Guinea.
1932. LIEFTINCK, Nova Guinea 15 Zool. 5, p. 567 (key ♂).

Material studied: — Australia: 1 ♂ (ad.), E. Queensland, Rockhampton, labelled: "R/32",/*Pseudagrion Australasiae* Selys ♂ Rockhampton (purple label in SELYS's handwriting)/gold/*Pseudagrion australasiae* Selys (Museum-label). Metatype of *australasiae*, in the Brussels Museum.

This specimen is of considerable interest inasmuch as it served to SELYS's description of *P. australasiae* (= *bengalense* LAIDLAW) in the Synopsis, along with the typical series of P. Besoar (Malaya). As I have pointed out elsewhere ("Konowia", 15, 1936, p. 167 - 170, figs.), the name *australasiae* should be

applied in the first place to the specimens from P. Besoar, while the Queensland specimens might be referable to an other species.

Now, our specimen from Rockhampton, labelled by SELYS himself *australasiae,* is certainly quite distinct from that species, as it is from any of the other described forms, except *P. papuense* TILL. I have not been able to satisfy myself that this specimen is certainly the true *papuense,* but although I had no occasion to obtain a paratype for comparison, I can give no reason for supposing that it is not correctly referred to that species.

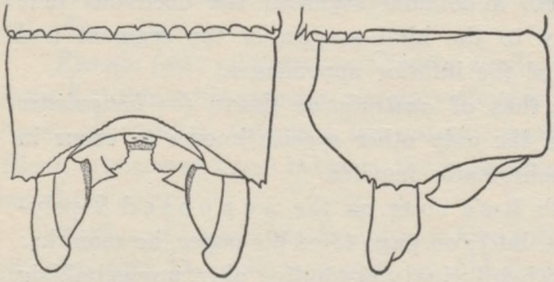

Fig. 20. Male anal apps. of *Pseudagrion papuense* TILL. from Queensland, dorsal view and right side.

In the structure of its appendages it agrees perfectly with TILLYARD's sketches of these organs. As regards colours, our example shows less of the extreme reduction of black marks upon head and thorax, but the face is without black spots (fig. 18a). On the other hand, the markings of the abdomen, especially the isolated, trapezoidal, black mark dorsally towards the apex of segm. 2, strongly suggests *papuense,* as do the other body-markings. In our specimen the 10th segment bears an X-shaped black dorsal mark instead of a crescentic black basal patch as occurs in the type from New Guinea.

The measurements are practically alike: abd. + app. 28.5, hw. 18.5, fw. 20, total length 35 mm.

Pseudagrion perfuscatum, sp. n. (fig. 21).

Material studied: — W. Borneo: 26 ♂, 1 ♀ (mostly ad.), Singkawang, Lohabang Rd., Tjapkala Rd., Mampawa Rd. near Sjakok, and environs of Bakoewan, Aug. 22 - 24, Oct 17 - 28, Nov. 5 - 16 and Dec. 7 - 9, 1931; 10 ♂, 3 ♀ (ad.), same loc., Montrado-Lohabang Rd. and Bengkajang, Jan. 16 - 20, July 12 — Aug. 9, and Nov. 7 - 11, 1932. All L. COOMANS DE RUITER leg., collected along small forest-brooks. Holo- and allotype: Bengkajang Rd., Nov. 5 - 16, 1931.

Male (ad.) — Labium light brown, labrum and anteclypeus sepia-coloured; postclypeus, genae and frons, as far upwards to level of median ocellus, a rich ferruginous or rather purplish-brown; similarly coloured are the first two joints of antennae, a spot in front of each lateral ocellus, and rather small, completely isolated, circular postocular spots. The remaining parts of the head buff-black dorsally. Rear of the head, excepted a clear yellow line along the eye-margin, jet-black, coarsely powdered with blue.

Prothorax sepia-brown, coarsely pruinose along sides.

Synthorax dusky brown, sutures black. A thick black line along median carina, diffusely limited exteriorly; a similar line at humeral suture, widened ventrally and occupying the dorsal third to half of mesinfraepisternum, and

the ante-alar triangles, black. Thoracic sides coarsely bluish pruinose. Mesepimera gradually more densely powdered with blue from above downwards. Lateral sutures scarcely visible, the brown ground-colour of metapleurae thickly powdered with pale blue, as are also the ventral side and the outer surfaces of the coxae. Aged individuals have the thorax so much obscured that only the middle of the mesepisternites remains brown.

Legs brown. Femora almost wholly darkened: a spot at base and the proximal half of interior faces remain ferruginous. Outer sides of tibiae yellowish brown, the inner ones black. Tarsi and spines black; claws ferruginous, tipped with black.

Wings hyaline, occasionally evenly tinged with yellow, especially in their distal two-thirds. Postnodal cross-veins $\frac{12-14}{10-11}$. Pterostigma small, diamond-shaped, dark red in colour.

First abdominal segment brown, with a blackish basal spot, usually invisible, the entire segment being densely powdered with blue. Dorsum and sides of 2 - 8, with the exception of vestigial anterior brown lunules, completely shining bronzy-green, the sides of segm. 2 being powdered with blue. Distal half of tergal margins pale brown underneath. Terminal segments, from base of segm. 8 towards apex, gradually widened apically, as in *pruinosum* and in all the races of *pilidorsum*. Segm. 9 deep brownish-red, above with a thick black stripe along posterior margin, occupying the distal half of the segment; 10 black.

Anal appendages slender in dorsal view, rather robust in side-view; superiors black, marked with reddish-brown interiorly; inferiors dark brown. Superior pair in dorsal view widely distant, divaricate, directed straight backwards, rather concave and each provided interiorly with a small, submedian, ventral denticle and, moreover, with a somewhat larger, rounded, subapical, dorso-median tubercle; in side-view they appear broad and almost straight cut off at apex. Inferior appendages decidedly shorter than superior pair, shaped as is shown in fig. 21.

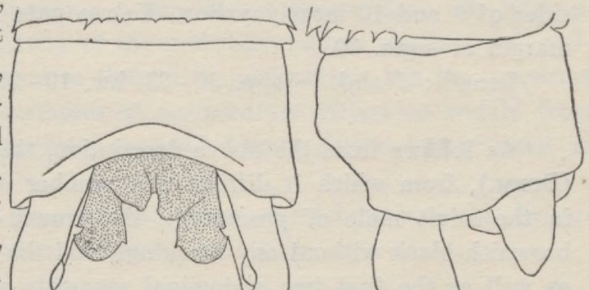

Fig. 21. *Pseudagrion perfuscatum*, sp. n. Male anal apps., dorsal view and right side.

Male (semiad.) — Differs from mature specimens by the absence of blue powdering upon the thoracic sides and on basal segments of abdomen. The black stripe along humeral suture is rather thickened at dorsal end of same, and is markedly widened ventrally, forming a spot-like marking situated in the edge between humeral and mesinfraepisternal suture. Ante-alar triangles filled in with brown. A short !-shaped black line at dorsal

end of first lateral suture, and a crescentic black mark at dorsal end of second suture.

Metepimerum and ventral surface of thorax pale yellowish-brown; coxae light brown. Wings hyaline, pterostigma sepia-coloured. The red marking at base of segm. 9 of abdomen ferruginous, very conspicuous.

Female (ad.) — Head coloured similarly to semi-adult males: face rather more cinnamon-brown than ferruginous. Black marks on the dorsum reduced to three black dots, one behind each of the ocelli, and a thick stripe surrounding the globular, somewhat triangular, postocular spots. Rear of the head as in male.

Prothorax black above, brown along side; dorsum spotted with brown, as follows: a transverse streak along anterior lobe, followed by a median twin-spot; a large, circular spot on each side, and a much smaller mid-dorsal twin-spot upon median lobe; three yellow marginal spots on the posterior lobe. Prothoracic horns long, acutely pointed, directed forwards and a little sidewards.

Synthorax coloured similarly to the semi-adult male, dorsum darker than the sides; median suture, ante-alar ridges and upper margin of mesopleurae bordered with black; two black dots on each side upon lower end of mesepimerum (just behind the prothorax), and the upper third of the mesinfraepisternum also black. Sides with the black spots as in the male. Ventral surfaces pale olivish-yellow, pruinose-white, as are the coxae and the lower ends of the second lateral suture.

Legs flesh-coloured; distal half of femora striped with black, the streak on posterior pair obliterated; tibiae pale yellow with a black interior line; tarsi obscured, claws reddish. All spines black.

Abdomen exactly similar to the male; the bronzy-green mark on dorsum of segm. 2 complete and but slightly narrowed towards the base of segment. Dorsum of segm. 8 - 10 wholly black, except yellow intersegmental membranes; sides of 9 and 10 largely yellow. Valves pale, not projecting beyond posterior margin of segm. 10.

Length: ♂ abd. + app. 30 - 33, hw. 19 - 21.5; ♀ 31.5 - 32, 22 - 23 mm.

As follows from the above description, this is decidedly not *P. pruinosum* (BURM.), from which it differs in a number of important characters. Firstly, in the adult male of *pruinosum,* the ground-colour of the thorax is velvet brownish-black without any markings, and the entire pro- and synthorax [1]) as well as the first two abdominal segments are densely powdered with blue, whereas in *perfuscatum* the sutures are black and only the sides and under surfaces of the thorax with the sides of segm. 1 and 2 are pruinose. Secondly, *pruinosum* is distinguished by the deep ochreous colouring of the face which contrasts sharply with the velvety black upper surface of the head. Even in very old males the upperside of the thorax of *perfuscatum* always remains brown, interchanged alternately with median and humeral brownish-black bands,

[1]) *Not:* "Thoraxdorsum tief samtartig rotbraun ohne Zeichnung, Seiten dicht weisslich bereift", as stated by RIS (Nova Guinea 13 Zool. 2, 1915, p. 97).

the sides only being powdered with light blue. This combination of colours gives the insect a striking appearance. The two last abdominal segments of *pruinosum* are also powdered with blue dorsally, whereas in none of the males of *perfuscatum* these segments are pruinosed, the ochreous basal ring on segm. 9 being always conspicuous.

The anal appendages of the male, although being very similar in principle, also differ in the two species. In *pruinosum* and its races the superiors in side-view are slenderer and bear a small, apical ventral projection which is absent in *perfuscatum,* while the inferior apps. of that species are longer than in *pruinosum.* The armature of the inner surface of the superior pair is likewise different.

The ♀ of *perfuscatum* may be differentiated from that of typical *pruinosum,* apart from the different shape of the prothoracic hind-lobe, by the following particulars. Rear of the head black, with a narrow, yellow stripe bordering the eyes (*pruinosum:* lateral two-thirds of the underside yellow with two curved black stripes entering into it from the mesial black spot); humeral suture with a black line, first lateral suture with a !-shaped upper line and dorsal third of mesinfraepisternum black (*pruinosum:* humeral suture with a black dot on upper end only, first lateral suture and mesinfraepisternites unmarked).

P. pruinosum (BURM.) has been recorded twice from the island of Borneo: it was reported from Mt. Merinjak (Sarawak) by LAIDLAW (Sarawak Mus. Journ. 2, 1915, p. 275) and from Murud (also Sarawak) by HINCKS (loc. cit. 4, 1930. p. 51). Although its occurrence in Borneo is by no means precluded, some little doubt arises as to the correct identification of these Bornean specimens (only 3 males have been made known).

Another point of interest seems to be the question whether *perfuscatum* might possibly be considered a participant of the formenkreis *pilidorsum* BRAUER, defined by me in a previous paper (Revue Suisse Zool. 43, 1936, p. 127 - 134, figs.). The close similarity of the male appendages suggests real affinities with *pilidorsum* (even more so than with *pruinosum*), but the colouring of the body of our Bornean examples of *perfuscatum* differs so widely from typical *pilidorsum* of the Philippines, that the former should better stand as a distinct species.

A noteworthy fact in the geographical range of *pilidorsum* is the discontinuous distribution of its races (LIEFTINCK, loc. cit.).

Teinobasis leonorae, sp. n. (fig. 22).

Material studied: — Malay Peninsula: 1 ♂ (ad.), Penang, STAUDINGER vend., unidentified in the University Museum of Michigan, Ann Arbor (no. 1152). The specimen is the holotype.

Male (ad.) — Labium, base of mandibles and genae yellow. Labrum orange with a brownish streak along side-margin. Anteclypeus dull orangish, post-clypeus reddish-black, slightly paler along base. Frons, to level of the transverse carina, orange; this colour for a short distance extends upwards along margin

of compound eyes. First two joints of antennae orange, the flagellum slightly darkened. Vertex and epicranium metallic-green, rather shining. A tiny orange streak between each lateral ocellus and the antennal base, and the occipital plate, orange. Rear of the head black, slightly pruinose.

Prothorax entirely orange, its posterior lobe very short, depressed, simply rounded.

Synthorax orange, marked only with a broad median longitudinal metallic bluish-green band, occupying almost the inner three-fourths of each mesepisternite; this band is only very slightly narrowed dorsally and its side-edges are rounded off ventrally. Ante-alar triangles orange, posterior ridge of each black.

Legs light orange; spines also pale in colour, numbering five on posterior femora. Tarsal claws lacking an inferior tooth.

Wings hyaline; neuration orangish. The nervure *Ac* situated much nearer Ax_2 than Ax_1. Postnodals $\frac{13.13}{12.13}$, subpostnodals $\frac{12.12}{12.12}$. M_3 and *Rs* well separated at base, *Rs* arising at the subnodus, M_3 distinctly curved and originating well proximal to it. Three antenodal postquadrangular cross-veins. Cu_2 zigzagged three cells distal to the subnodus. Pterostigma elongately lozenge-shaped, sides parallel, not quite covering one cell, pale greyish-brown in colour, surrounded by a yellow line.

Abdomen slender, dull bronzy-brown to almost black on first seven segments; the marks become gradually darker from before backwards and, on the basal segments, are ill-limited laterally. Sides of 1 - 2 and lower margin of 3 - 7 orangish. Segm. 3 - 6 with tiny yellow basal annules, interrupted mid-dorsally. Basal two-thirds of segm. 8 reddish-black (? due to decomposition), turning to orange distally; 9 - 10 and appendages orange.

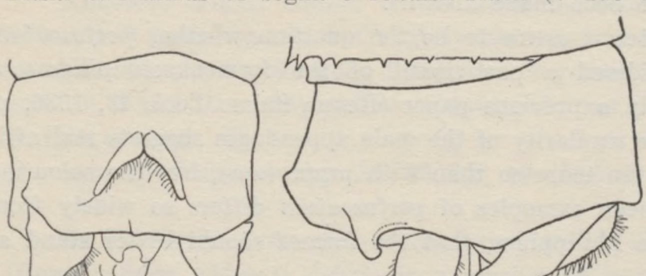

Fig. 22. *Teinobasis leonorae*, sp. n. Penang. Male anal apps., dorsal view and right side.

Upper branch of sup. anal app. about two-thirds of the length of segm. 10, its inner margin strongly incurvate in dorsal view, the apex turned inwards with a black, hook-like tip. Lower branch almost as long as the upper one, triquetral, rather broadened dorso-ventrally, its apex upcurved, black. Inferior appendage distinctly shorter than the superior one, stout at base, tapering to an acute, black-tipped point and provided along its upper margin with a low tubercle (fig. 22).

Quite distinct from the other Malaysian species by the shape of its appendages. Allied perhaps most closely to *T. rajah* LAIDLAW, from Sarawak,

which is said to have the upper pair of appendages very small and curved inwards at their extremities, with a small inwardly directed spur.

Dedicated to Mrs. LEONORA K. GLOYD, of the University Museum of Michigan, Ann Arbor, who has very generously entrusted me with the FÖRSTER collection of South East Asiatic Odonata and part of the WILLIAMSON collection.

Amphicnemis kuiperi, sp. n. (fig. 23).

Material studied: — Billiton I.: 21 ♂, 19 ♀ (semiad. or ad., ♀ of the red and blue colour-phase), Tjeroetjoek, Tandjong Pandan and Seroe (W.B.), Aug. to Dec. 1935, Febr. 1937; id., Mendanau Id., Febr. 3, 1936. All F. J. KUIPER leg. Holo- and allotype: Tjeroetjoek, Aug. 1935.

Male (ad.) — Labium yellowish-white. Genae and mandible-bases pale yellow, the latter with a large, greyish-black spot. Labrum shiny black, the distal third sharply defined ochreous (or yellowish-white); anteclypeus ochreous-yellow with an undulated blackish-brown basal stripe. Postclypeus shining black. Frons with a well defined, transverse, ochreous band occupying the lower three-fourths of the vertical surface, widest laterally. Area between this band and the margin of compound eyes on either side black. A yellow anterior spot at the base of each antenna; these black, the first two joints pale apically. Dorsal surface of head bronzy-black, the occipital lobes rather shiny, metallic-green. Rear of the head black.

Prothorax, dorsum brilliant metallic-green or bronzy-black, sides clear ochreous; the dorsal black marking strongly constricted behind the anterior lobe. Posterior lobe rather short, depressed, its margin evenly rounded.

Dorsum of synthorax, as far down as the first lateral suture and including the ante-alar triangles, brilliant metallic or bronzy-green with reddish or purplish reflections in aged individuals. Postero-dorsally, the metallic colour surpasses the first suture, forming a slightly angular off-shoot which terminates against the dorsal margin about mid-way between the first and second lateral sutures. A minute yellow spot along dorsal margin of mesepimerum about extreme upper end of the humeral suture. Dorsal half or mesinfraepisternites also bronzy-green, its lower border in line with that of the mesepimeral colour. Thoracic sides pale ochreous fading to yellow underneath. Dorsal margin of metepimerum with two black points, one at dorsal end of second suture and one about the postero-ventral edge of the said space.

Femora pale ochreous, all of them with sharply defined black apical rings and extreme bases of tibiae also black. Tibiae and tarsi yellow; tarsal claws without inferior tooth. Spines black.

Wings hyaline. Postnodals $\frac{12-13}{10-11}$. Origin of M_3 usually distinctly distal to the subnodus, rarely at the subnodus [1]). Pterostigmata equal in front and hind pair of wings, dark grey with a narrow pale margin; costal side almost

[1]) In RIS's key to the two Bornean species *A. wallacei* and *martini* (Ann. Soc. ent. Belg. 55, 1911, p. 236), one should read M_3 instead of *Rs*.

twice longer than opposite side; proximal side very oblique, distal side but slightly convex.

Abdomen extremely thin and slender, as in all species of *Amphicnemis*, from base of segm. 8 till the apex rather widened in both dimensions. Segm. 1 - 2 brilliant metallic-green above, clear ochreous aside; the dorsal mark of 1 is narrowed anteriorly and 2 has a very narrow basal annule, interrupted on mid-dorsum. The succeeding segments are of a dull brown colour, becoming progressively darker posteriorly (7 - 9 black, often with purplish reflex), their under surfaces yellowish-white. Segm. 3 - 5 or 3 - 6 have, in addition, very diffuse pale brown subterminal and basal annules, which are often indistinct or absent altogether. Segm. 10 indistinctly black, bases and sides dirty ochreous; apical tonguelet of the tergite not incised, simple.

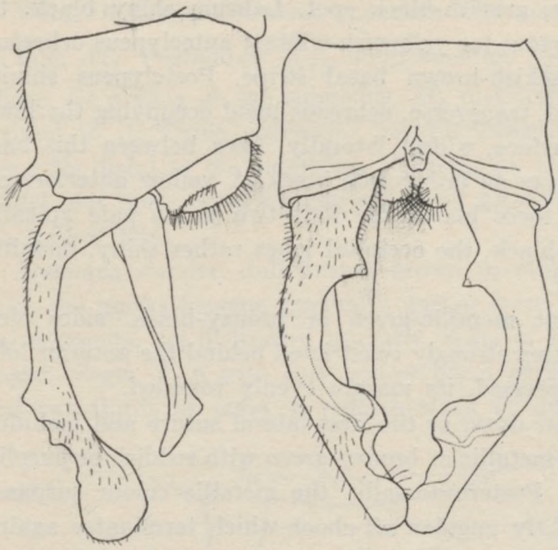

Fig. 23. *Amphicnemis kuiperi*, sp. n. Male anal apps., right side and dorsal view.

Anal appendages entirely pure white in semiadult males, growing darker in aged individuals; in very matured specimens they are dull brownish-ochreous, mottled with black. Superior pair evenly but distinctly curved in profile view, strongly outbent on middle and finally again approximated in dorsal aspect, with a very definite sub-apical nod, when viewed obliquely from above. The sub-apical tubercle upon this nod smoothly flattened interiorly and surrounded by an almost acute posterior rim. Inferior appendages shaped as in fig. 23.

Female (ad.) — Head coloured as in male; the pale frontal band usually narrowly constricted in the median line, dull bluish instead of ochreous.

Prothorax dull brown above, sides dark bluish-green or blue, slightly pruinose below. Posterior lobe somewhat longer than in male, rather rectangular in dorsal aspect but with the side-edges rounded; the lobe consists of three parts, *viz.:* one median horizontal division with a strong mid-dorsal longitudinal carina on each side of which the surface is rather deeply and triangularly impressed, and a lateral part which is about half so broad and whose surface is also somewhat concave. Seen from aside the posterior margin of the lobe is somewhat upcurved, and when looked at from behind the margin is distinctly undulated.

Synthorax with the mesepisternites uniform dark olive-brown; sometimes with traces of pale antehumeral stripes due to decomposition; sides throughout

dark blue, or blue-green, fading to whitish on postero-dorsal third of metepimerum. Mesinfraepisternites with a brownish stripe along humeral suture, and the dorsal end of second suture also with a small brownish dot. Ante-alar triangles metallic-green. Under surfaces pale blue.

Coxae yellow, pale blue at base; legs yellowish-white, all femora with a black exterior stripe and with the knees also blackish; tarsi pale ochreous. Spines brown.

Wings hyaline; neuration as in male. Pterostigma scarcely paler in colour.

Abdomen coloured much as in the male but dorsum of basal segments dark brown with low metallic sheen on segm. 1 only; sides of 1 - 2 clear yellow to pale green, the dorsal mark sharply delimited and decidedly narrowed anteriorly. Segm. 9 bears a conspicuous clear yellow dorso-lateral spot on each side behind the middle and 10 is entirely pale blue (or white).

Anal appendages and valves white or yellowish, darkened in aged individuals; valves projecting well beyond end of segm. 10.

Female (red, juv.) — Head coloured as before, pale tints lights yellow, strongly contrasting with the shiny black parts. Prothorax, legs and synthorax throughout carmine in the darkest individuals, coral-red in juvenile specimens (both colours according to RIDGWAY's standard). Posterior lobe of prothorax shaped exactly as in the adult. Ante-alar triangles bronzy-green. Under surfaces flesh-coloured. Tibiae (including the spines) paler towards apices and tarsi yellow.

Pterostigma centred with grey. Coloration of the abdomen paler than in the adult female but all markings identical.

Length variable: ♂ abd. + app. 33.5 - 36.5, hw. 19 - 20; ♀ 32 - 35, 19.5 - 21.5 mm.

N.B. — Throughout our series of females the red body-colour corresponds with a weak condition of the integument, none of the red females having the abdomen so thoroughly chitinized as the blue coloured ones. It is therefore quite evident that certain females of *Amphicnemis* pass through red colour-phases to the adult stage, and that two different forms do not exist.

This species appears to find its nearest ally in *A. ecornuta* SELYS, from W. Sumatra (Fort de Kock) and N.E. Sumatra (Soekaranda), which is also characterized by the absence of a median posterior spine to the prothorax in both sexes.

A. ecornuta, according to SELYS and KRÜGER, is a much larger insect (♂ abd. 41 - 44, hw. 24.5 - 27; ♀ 41 - 43, 26.5 - 27 mm), and the male of it may be distinguished from *kuiperi* by the presence of an upwardly directed spine to the basal third of the inferior appendage (a character mentioned only by KRÜGER), which is not present in *kuiperi*.

Mortonagrion appendiculatum, sp. n. (fig. 24).

Material studied: — Billiton I.: 1 ♂ (ad.), N.B., Sidjoek, Dec. 16, 1935; 30 ♂ (ad.) 18 ♀ (ad.-juv.), W.B., Tandjong Pandan, June 17 - 19 and 24, 1936, Jan. 6 - 17, and Febr. 16 - 18, 1937, F. J. KUIPER leg.

Male (ad.) — Labium yellow. Anterior surface of head, as far upwards as the base of antennae, orange-yellow, the labrum bright orange. Frons, vertex and epicranium deep velvet-black, a small area behind posterior ocelli on the occiput indistinctly brown. Antennae pale brown. Postocular spots blue, widely distant, placed in the long axis of the head, reniform (rectangularly excised mesially), fitting close against the margin of compound eyes. Rear of the head bright greenish-yellow.

Prothorax purplish-brown with indistinct, cloudy, dark brown spots. Posterior lobe small, depressed, projecting straight backwards under right angles and forming a short rectangular plate, slightly concave dorsally, a little broader than long though measuring only one-third of the total width of the hind margin of the prothorax.

Dorsum of synthorax, to a level about half-way between humeral and second lateral suture, warm purplish-black, the median carina and the humeral suture finely reddish-brown. Antehumeral stripes reduced so much as to be completely divided up into a bluish point just anterior to the mesinfraepisternal suture, and a somewhat larger, oblique, elongate spot just below each ante-alar triangle and almost touching the humeral suture. Metepisternum with a blue stripe, slightly oblique and pointed posteriorly, along the spiracle, followed by a much smaller, rather triangular, blue spot filling up most of the upper edge. Metepimerum yellowish, usually with an indistinct ferruginous or brownish stripe over the second suture. Venter of thorax pale ochreous.

Coxae and legs ochreous-yellow; femora with indistinct subterminal rings, tibiae with a diffuse brownish spot near base, and apex of last tarsal joint blackish. Tarsal claws and spines ferruginous, the former distinctly toothed.

Wings slightly tinged with greyish-brown. Pterostigma smaller than the underlying cell, dark brown, elongately lozenge-shaped, rather oblique; in hind wing about 1½ times longer than high, in front wing slightly shorter. Postnodals $\frac{8-9}{6-7}$, subpostnodals $\frac{7-8}{6}$.

First segment of abdomen with a three-pronged black dorsal mark attached to the posterior margin, and with the sides blue. Segm. 2 dark purplish-brown on the back and alongside; this colour does not extend to the base of the segment, except in the median line, on each side of which a sky-blue basal spot is placed, restricted to the dorsum of the segment. Ground-colour of segm. 3 - 6 pale yellow, but all segments with dark brown marks, covering most of the dorsum and sides though constricted before the end and expanding laterally to form deep black apical rings, occupying about one-sixth of the length of segment. Besides, each segment bears a narrow but well defined basal ring, blue on dorsum, yellowish aside, occupying slightly less than one-seventh of

the length of each segment. Segm. 7 is wholly black, except a sky-blue basal spot, restricted to the dorsum, and a mid-dorsal blue point, placed just before the posterior margin of the segment (the latter sometimes wanting). Segm. 8, with the exception of a thick, black stripe each side along lower margin of tergite, sky-blue; 9 black, with a large blue dorso-lateral spot, widest at base, tapering and rather constricted posteriorly but not reaching the posterior margin. Segm. 10 very short, black.

Anal appendages black. Inferior clusive of the labrum, deep blue instead about four times as long as the superiors which are more or less truncated apically, the tips of each being rather flattened and framed dorsally (fig. 24).

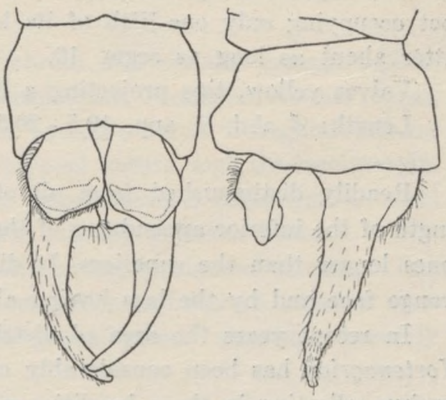

Fig. 24. *Mortonagrion appendiculatum*, sp. n. Male anal apps., dorsal view and right side.

Female. — Much resembling the male but differing as follows:—

Anterior surface of the head, inclusive of the labrum, deep blue instead of orange; posterior limit variable: in most specimens the blue colour does not extend upwards over the frons but in others the lower portion of the frons is likewise blue. Frons and the entire upper surface of head otherwise deep bronzy-brown, the postocular spots usually well visible, oblique, comma-shaped, blue, placed near the eye-margin (in subadult females slightly enlarged and reniform). Rear of the head dull yellowish.

Prothorax dark bronzy-brown, sides a little paler, pruinose-blue along margin. Posterior lobe with the lateral divisions extremely short and well rounded, median division projecting posteriorly as a transverse lobe which is much longer than the lateral divisions and about twice as long as broad, its side-edges well rounded and its apical margin very slightly convex. Laminae mesostigmales well developed, curved slightly anterad so as to form minute curled hooks, when seen in oblique frontal view.

Synthorax coloured as in male; immediately behind each of the lam. mes. is a blue antehumeral (mesepisternal) stripe, widest below, extending upwards to about one-quarter the length, where it tapers to a point; on the opposite side, below the ante-alar triangles and near the humeral suture, are placed similar, though still shorter, comma-shaped blue spots which are pointed ventrally. The thoracic sides are coloured similarly to the male, only the lower third of the mesinfraepisternites and a small ventral area of the metepisternum being yellowish; blue metepisternal spots very distinct but in old specimens barely visible because of the sides being overled with bluish pruinescence. Under surfaces pale.

Wings as in male, membrane slightly tinged with yellow, especially the

posterior pair. Pterostigma of front wing darker brown and distinctly shorter than that of the hind one.

Abdomen marked similarly to the male but the sky-blue basal spots very conspicuous, larger, and extending also over part of the sides to the proximal segments, that on dorsum of segm. 2 interrupted, those on 3 - 7 similar to one another, largest on segm. 5. Segm. 8 black with a transverse blue basal dorsal spot occupying only one-fifth of its length; 9, 10 and appendages black, the latter about as long as segm. 10.

Valves yellow, tips projecting a little beyond apex of last segment.

Length: ♂ abd. + app. 19.5 - 20.5, hw. 10.2 - 10.5; ♀ 18 - 19, 11 - 12 mm.

Readily distinguished from all other species of the genus by the great length of the inferior appendages of the male, which are fully two and one half times longer than the superiors. It differs further from other species by the orange face and by the legs having almost the same colour.

In recent years the area of distribution of various Malaysian species of *Mortonagrion* has been considerably extended, chiefly as a result of more intensive collecting in those localities where they find a suitable home in their larval state, such as in well-aërated forest-marshes in low country, coastal swamps, etc. (see LIEFTINCK, Stylops, 3, 1934, p. 15).

In the following list I have entered the names of all the species at present known, with a quotation only of the original description, followed by the typical locality [1]). I have taken this opportunity to put on record also additional localities, available in literature or known to me from specimens in the Buitenzorg Museum collection. These references to localities deal exclusively with thoroughly identified material, doubtful cases having been omitted.

1. *M. amoenum* (RIS) (Tijdschr. v. Ent. 58, 1915, p. 10, figs. — ♂♀ Simaloer I.)
   F u r t h e r r a n g e: ♂♀ C. and S. Sumatra; ♂♀ S. Java; ♀ W. Borneo; ♀ ? Celebes (RIS, 1930).
2. *M. appendiculatum,* sp. n. (huj. op. — ♂♀ Billiton I.)
3. *M. falcatum* LIEFT. (Stylops, 3, 1934, p. 12 - 15, fig. 4. — ♂♀ Karimoen Djawa I.)
   F u r t h e r r a n g e: ♂♀ Billiton I.; ♂ W. Java.
4. *M. gautama* (FRASER) (Mem. Dept. Agric. India, 3, 1922, p. 50. — ♀ Assam).
5. *M. selenion* (RIS) (Suppl. Entom. 5, 1916, p. 26, figs. — ♂♀ Japan).
6. *M. simile* RIS (Arkiv f. Zool. 21A, 1930, p. 6 - 10, fig. 3. — ♂♀ N.E. Sumatra).
   F u r t h e r r a n g e: Sumatra generally; ♂ W. Borneo.
7. *M. varralli* FRASER (J. Bomb. Nat Hist. Soc. 27, 1920, p. 148, fig. (wings). — ♂♀ W. India). This species is the genotype.

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[1]) Recently, SCHOUTEDEN has recorded an unnamed species of *Mortonagrion* from the Belgian Congo (Ann. Mus. Congo Belge, Tervueren, 1934, Zool. Sér. III, Sect. II, T. III Fasc. 1, p. 83).

Fam. LIBELLULIDAE.

Brachygonia puella, sp. n. (fig. 25).

Material studied: — Billiton I.: 10 ♂, 4 ♀ (semiad.-ad.), W.B., Seroe, April 2, June 16, Sept. 23, and November, 1936, F. J. KUIPER leg. Holo- and allotype: Seroe, April 2, 1936.

Nearest to *B. ophelia* RIS.

Male (ad.) — Labium pale yellow. Labrum and clypeus creamy-yellow, the clypeus usually with slight greenish intermingling. Frons and vertex rugose, throughout brilliant metallic-green or -blue, except a small triangular creamy spot filling up the lateral edges between clypeal suture and the eye-margin. Occipital triangle shining black, with two approximated, clear yellow, oval spots behind. Rear of the head glossy black, slightly pruinose blue.

Pro- and synthorax unicolorous metallic-green, pruinosed more or less densely, except the mesepisternites, which remain metallic-green even in very adult specimens, in semi-adult males the ground-colour showing obscurely through the blue pruinescence.

Coxae black, pruinose-blue, trochanters brownish, legs otherwise entirely black, the tarsal claws chestnut-coloured.

Wings hyaline, slightly tinged with grey-yellow in very matured specimens; neuration brownish-black. Intermediate in shape between *oculata* and *ophelia*, the postnodal half almost identical to *ophelia*. Position of nodus very slightly more distal than in that species though distinctly proximal to the middle of the wing. Nodal index $\frac{5\ 6.6.5}{5.5\ 5.5}$. Occasionally 5 antenodals in one of the front wings. Triangle of front wing less oblique, the lower sector or *arc* forming approximately a right angle with the distal side of *t;* costal side of *t* broken, the distal portion longer than in *ophelia*. Discoidal field of front wing narrow, with a single row of cells from base to about one cell distal to level of nodus, thence much widening, and usually with 5 marginal cells (almost identical in shape to *ophelia* but not so narrowed on middle and basal cell not divided). Anal area of front wing not differing from that species. Position of hind wing triangle as for genus, its shape much resembling that of *oculata:* very narrow, costal side distinctly broken distally, and proximal side much shorter than in *ophelia*. Discoidal field similar to the other species and Cu_1 forked basally so as to rise from the distal side of *t* and Cu_2 as well. A_1 slightly curved at origin (convex basally) but soon strongly arched towards the wing-margin (concave basally), forming a very irregular "anal loop" with A_2, consisting of two cells; three marginal cells between A_1 and A_2. A_3 not developed. Area posterior to A_2 similar to *ophelia* but wider. Venation otherwise much as in that species but distal course of main veins slightly more curved toward the wing-margin. Pterostigma pale brownish-yellow, shaped as in *ophelia*. Membranula very small, greyish.

Abdomen comparatively long and extremely slender, quite different in shape from the two other known species. Basal segments slightly but distinctly inflated in lateral dimension, about twice as high as the distal end of segm. 3. From the base of 3 the abdomen is gradually narrowed (0.3 mm on middle of segm. 5) with very thin and cylindrical segments; from base of 6 it widens gradually, reaching its widest point at end of segm. 9 (0.8 mm); 10 again slightly narrowed posteriorly. Coloration throughout shining bronzy-black with no other pale markings than a diffuse yellow spot along the sides of segm. 1 (often invisible from pruinescence) and a somewhat larger one on each side before the transverse carina of segm. 2; in not fully adult males a tiny yellow lateral point is also perceivable behind the carina of the same segment. Sides of 1 - 2 and posterior half of dorsum of 2 pruinose blue in adult specimens.

Fig. 25. *Brachygonia puella*, sp. n. Male genitalia of second segment of abdomen, left side view.

Genitalia black, shaped as in fig. 25. Genital lobe long and narrow, tip furnished with a bunch of ca 5 - 6 short and stiff ochreous setae, which are directed upwards.

Anal appendages black, a little shorter than segm. 9 + 10, very similar in outline to those of *oculata* but slenderer, the apices of superior pair less acutely pointed.

Female (ad.) — Almost identical to the male but differing as follows: Mouth-parts yellowish-white; labium unmarked, labrum with a diffuse brownish mid-basal spot, mandible-bases greenish-yellow, tips black. Clypeus pale greenish-white, the postclypeus with a transverse black basal streak on middle, ill-limited anteriorly. Head otherwise as in male.

Pro- and synthorax not different in colour. Bases of front and hind wings with diffuse greyish-yellow rays in *sc* and *cu* not extending further distad than the first cross-vein in these spaces. Pterostigma pale greyish-brown. Neuration as in male.

Abdomen slender; basal and terminal segments a little widened in lateral dimension, intermediate segments thin and cylindrical. Colouring identical to the male but the pale yellow spots along the sides of segm. 1 - 2 slightly enlarged. Sides of 1 - 2 thinly pruinose.

Vulvar lamina short and transverse, about one-third of the length of the ninth sternite, not projecting ventrad, its side-edges well rounded. Anal appendages widely distant, about twice longer than segm. 10, thin and cylindrical, tips acutely pointed.

Length: ♂ abd. + app. 14 - 15, hw. 16.0 - 16.7, pt. 1.8; ♀ 14.2 - 14.8, 16.7 - 17.3, 2 mm.

Easily distinguished from *oculata* (BRAUER) and *ophelia* RIS by the uniform metallic-green or -black colouring of the body and by the anal area of the hind wing.

The generic diagnosis of *Brachygonia* as given by RIS (Cat. Coll. SELYS, Libellulinen, fasc. 11, 1910, p. 352) needs a slight modification in some respects. The posterior lobe of the prothorax in none of the species is elevated ("aufgerichtet") but lays down on the back of the synthorax. The 8th sternite in the females of *ophelia* and *puella* is not prolonged apically into a long, downwardly projecting valvula vulvae. Lastly, in *puella*, the lower sector of the arculus forms a straight angle with the distal side of the front wing triangle ("die Abknickung von *ht* erreicht den rechten Winkel nicht", loc. cit.).

B. oculata occurs also in Banka and Billiton, and I possess a small series of both sexes of the rare *B. ophelia* from W. Borneo, collected by Mr. COOMANS DE RUITER.

Fam. CORDULIIDAE.

Hemicordulia magica, sp. n. (fig. 26).

?1934. SCHMIDT, Arch. f. Hydrobiol. Suppl. 13, p. 377 - 378. — ♀ Bali, Danoe Bratan (*Hemicordulia* sp.).

Material studied: — Bali I. (East), 1 ♂ (ad.), Mt. Abang, 1900 m alt., April 7, 1936, "on mountain-ridge", C. G. G. J. VAN STEENIS leg. The specimen is the holotype.

Allied to *australiae* (RAMB.).

Male (ad.) — Labium yellow, labrum greyish with its anterior border orange. Clypeus and side-edges of frons dirty greyish. Anterior surface of frons pale orange, this colour slightly deepening towards the upper margin but fading to greyish dorsally along the eye-margin; dorsal surface with a transverse, sharply demarcated, brilliant metallic-green mark, which is only little broader than the vertex at base. Vertex rather high, trapezoidal in form, upper margin and side-edges well rounded, almost straight in frontal view; greyish-brown basally, turning to pale orangish on upper half. Pile on clypeus yellow, on frons and vertex long and dense, blackish-brown. Occipital triangle chestnut-brown, lighter on each side of the middle; pile blackish above, silvery-white posteriorly.

Ground-colour of pro- and synthorax a dull greyish- or olivish-yellow with brilliant metallic-green markings much reduced and generally ill-defined, as follows: — mesepisternum with an indistinct, squarish, low metallic spot on each side of the mid-dorsal carina just in front of the ante-alar triangles. A diffuse green band along the humeral suture, about 1 mm wide and continuing downwards along the mesinfraepisternal suture, thence curving gently backwards around the shoulders towards the spiracle, where it suddenly stops. The lower portion of the mesepimera thus surrounded by the metallic stripe, each with a clear yellow spot, well marked off ventrally against the metallic band

but indistinctly limited dorsally and merging into the greyish colour of the thoracic sides. Metepimerum also dull olivish-grey but with fairly distinct, straight, metallic-green band bordering the second suture and occupying about the anterior two-fifths of that space (width about 1.3 mm); ventrally, this metallic band ceases at margin and is joined by a small but distinct clear yellow marginal spot. Mid-dorsal carina of thorax brown, ante-alar triangles olive-yellow and the under surfaces pale olive-grey. Pile moderately dense, yellowish-white.

Legs slender; coxae pale brown, legs black except the inner $^4/_5$ of anterior femora and the trochanters of middle pair, which are pale brown. Tibiae and tarsi black. Posterior femora reaching back to the middle of segm. 2 of abdomen. Tibial keels present on first and third pair of legs, dark reddish-brown, those on the first pair extending basad to slightly beyond the middle of their length, those on the hind tibiae almost to the base.

Wings short, very broad, shaped as for genus. Neuration dark brown but anterior wing-veins, up to the nodus, pale brown and costa very distinctly yellow anteriorly; antenodal cross-veins in *c* and *sc* also yellowish. Membrane strongly tinted with brownish-yellow, especially in the discoidal area, but with no indication of basal yellow spots. Nodal index $\frac{5.7.7.5}{6.5.5.6}$. Cross-veins in $t\ \frac{1.1}{0.0}$; *ti* three-celled. No supplementary bridge cross-veins and no additional cubito-anal cross-veins. Pterostigma small, very dark brown. Membranule whitish basally, changing into brown.

Abdomen slender. Segm. 1 - 3 slightly widened (2.5 mm broad over the middle of segm. 2) and a little constricted on middle of 3 (1.5 mm), thence again very slightly expanding and almost parallel-sided up to the end of segm. 10 (widest point on segm. 6 2.3 mm, at end of segm. 10 2.0 mm). Segm. 1 - 2 dull olive-yellow, not metallic above but with a glossy metallic-black spot upon the middle of the sides, that on 2 extending from base to apex of segment. Segm. 3 with a complete, dull metallic-green longitudinal band restricted to the dorsum though expanding posteriorly to form an indistinct bronzy-black apical ring roundabout the segment, occupying about one-fifth of its length; sides and under-surfaces otherwise dull orangish with indefinite antemedian dark spot along lower margin, just in front of the transverse carina. Segm. 4 - 7 with broad metallic-green dorsal marks, constricted anteriorly and after their middle so as to form bilobate ochreous side-spots, which are well visible from above. On segm. 4 and 5 these marginal pale spots are almost completely divided into two portions, the posterior one being semicircular in outline and much the higher of the two. On 6 and 7 the spots are broadly connected along margin; on 6 the anterior portion of it is largest and rather triangular in side-view (extending ¾ upwards along anterior margin of segment), the posterior one being much the lower of the two; on 7 the constriction of the lateral spot is unapparent and the posterior portion is still lower than that of segm. 6. Segm. 7 - 10 are bronzy-black, except the ventral pieces of the 7th tergite, which bear

ill-defined ochreous spots. The ventral portions of the tergites 4 - 6 are brownish-yellow, the apical fifth of each of them being black.

Genital hamule brown, turning to pale yellow distally; slender, evenly nar-towards apex which is gently curved upwards and a little sidewards; tips not projecting beyond posterior suture of segment. Genital lobe much shorter than the hamule, well rounded, black.

Anal appendages black; superiors a trace shorter than segm. 9 and 10 taken together, rather strong, at first straight and cylindrical, thence slightly constricted and bowed ventrad, with the distal portion rather much swollen and directed straight backwards; each with a very strong, hook-like interior spine (originating from the d o r s a l portion of the appendage), which is directed inwards and slightly downwards almost under right angles. Inferior appendage shorter than superiors, narrowly triangular, slightly curved, simple (fig. 26).

Length: abd. + app. 35.5, hw. 30.5: 11, pt. $\frac{1.7}{1.5}$ mm.

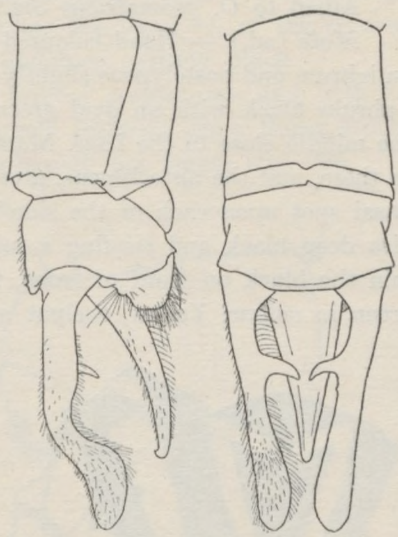

Fig. 26. ***Hemicordulia magica*, sp. n. Male anal apps., right lateral and dorsal view.**

This new species, though closely related to *australiae*, differs from that species by its sombre colours, the ochreous markings on the sides of the abdominal segments being decidedly more reduced than in *australiae*. On the other hand, the basal segments of the abdomen of *magica* are not metallic-green, as is the case in adult specimens of *australiae*, and the vertex is not metallic, while the green spot on the frons is also reduced and confined to its middle. In *magica* segm. 10 is entirely black, whereas in *australiae* the distal half of it is yellow. The anal appendages are similar in principle but the superiors are of more robust build and distinctly shorter than in *australiae*. The pilosity of the body of *magica* is also worthy of note and probably correlated with its occurrence in the higher mountain zone.

According to TILLYARD, *H. australiae* is a coastal species of eastern distribution and it has non-migratory habits (Trans. New Zealand Institute, 44, 1911, p. 126 - 127).

The immature ♀ described by SCHMIDT from the Bratan Lake in Central Bali (ca 1300 m alt.), is almost certainly conspecific with our male from Mt. Abang (East of the Batoer Lake, about 70 km more eastwards). The shape of the vulvar scale in this specimen is said to agree with my sketch after the allotype of *H. australiae*. *H. magica* is possibly restricted to mountainous areas.

The genus *Hemicordulia* stands in need of revision, and figures of the genital structures of both sexes are very needed.

Fam. GOMPHIDAE.

Onychogomphus rappardi, sp. n. (figs. 27 - 28).

Material studied: — S.W. Sumatra: 1 ♂ (ad.), Benkoelen Residency, Redjang distr., Pagar Goenoeng, 550 m alt., "open stream", Dec. 12, 1936, F. W. RAPPARD leg. Holotype.

Allied to *O. geometricus* SELYS.

Male (ad.) — Head coloured similarly to *geometricus*, the pale markings on labrum and postclypeus slightly more restricted. Labium dirty greenish-white. Labrum black with an oval green spot, placed transversely on either side of the middle close to the base. Mandible-bases, a small spot immediately lateral to these, and the anteclypeus, green. Postclypeus black with a minute ochreous basal spot upon each of the side-lobes. Frons black anteriorly, the basal half also deep black and sending a medial prolongation forwards in the sulcus to join the black on front of frons, the isolated upper spots rounded off behind, green in colour. Vertex, occiput and rear of the head unicolorous black. Antennae black, flagellum dark brown. Occipital ridge shaped as in *geometricus* and fringed with long black hairs.

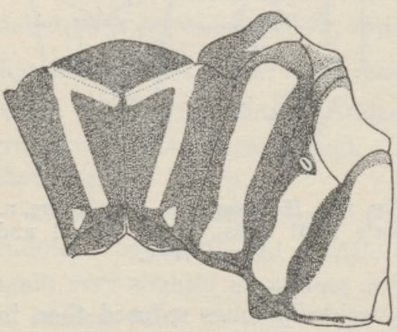

Fig. 27. ***Onychogomphus rappardi,*** **sp. n. Colour-pattern of synthorax.**

Prothorax black, the anterior lobe spotted with yellow.

Synthorax black with the green colour of the sides predominating (fig. 27). No vestiges of a humeral line but dorsal humeral spot conspicuous. Metepimerum almost entirely green, as are the under surfaces of the thorax. A diffuse, brown, crescent-shaped spot on poststernum, slightly pruinose.

Legs black except that the inner surface of the anterior pair of femora bears a greenish stripe along the whole length.

Wings suffused with greyish-brown all over the membrane. Nervures all black. Pterostigma deep black, braced, covering 3 - 4 cells. Nodal index $\frac{10.14.15.8}{9.11.10.9}$. Neuration practically identical to *geometricus* and agreeing also in almost every detail with WILLIAMSON's photograph of the wings of *"saundersii"* (Proc. U.S.N.M. 33, 1907, p. 310 fig. 35). Anal triangle 4-celled, anal loop two-celled. A single row of postanal cells in both front wings. Two undivided postanal cells between anal triangle and the loop. Cross-veins between sectors of *arc* to the bifurcation of M_{1-3} $\frac{2.2}{1.1}$. Fork of M_{1-3} symmetrical.

Abdomen shaped as in *geometricus;* black, marked with greenish-yellow, as follows. Segm. 1 with a mid-dorsal green spot and with the sides also largely green. Segm. 2 black above, green alongside; dorsum with a complete, longitudinal, green band expanding very slightly mid-way its length. Auricles yellow-

green, shaped as in *geometricus*. Segm. 3 with a yellow-green basal ring, occupying $^1/_5$ of the length and not quite reaching lower margin of segment, and a very narrow, mid-dorsal oval spot, pointed on both ends. Segm. 4 - 6 each with a complete yellow basal ring, occupying hardly more than $^1/_6$ of the length, each of these rings finely indented by black posteriorly for about one-half of its depth. Segm. 7 also with a yellow ring, which is a little larger than those on the preceding segments, occupying the basal $^2/_5$ of the segment and straight cut off behind. Remainder of abdomen entirely black.

Genitalia: (as compared with those of typical *geometricus* and with my sketch of *geometricus perplexus*) not or scarcely differing from those species, except that the basal setae on the posterior hamuli are longer (fig. 28).

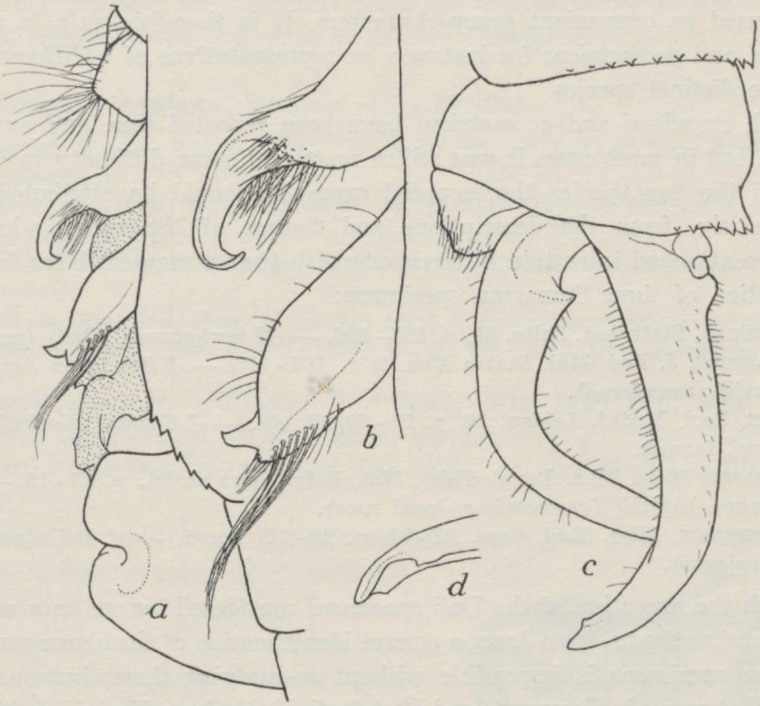

Fig. 28. ***Onychogomphus rappardi*, sp. n. *a*, genitalia of second abdominal segment, left side view; *b*, hamuli more highly magnified; *c*, left side view of ♂ anal apps.; *d*, left superior app., interior view.**

Anal appendages almost identical in shape to those of *geometricus* but quite differently coloured. Basal two-thirds of superior pair light yellow, distal third gradually darkening, almost black dorsally but ill-limited laterally, with the lower portion yellowish and the tips brown. Superiors with the tips obliquely truncated and slightly excavated in side-view; interiorly, each of them is still more obliquely excised, as is shown in fig. 28d. Inferior appendage deep black, the branches provided with a strong, though not very acute, basal tooth, which is directed upwards and outwards; tips broken off (fig. 28c).

Length: abd. + app. 40, hw. 30, pt. 3.7 mm.

Female unknown.

Named in honour of engineer F. W. RAPPARD, forest-officer of the Residency Benkoelen.

As has been pointed out already by F. RIS, in his paper on Sumatran dragonflies (loc. cit., postea), the members of the *saundersi*-group of *Onychogomphus* are to be distinguished from the *geometricus*-group by the shape of the accessory genitalia of the second segment of the male. On comparing HAGEN's sketches of *saundersi* and FRASER's of *duaricus* with those given by me for *geometricus, geometricus perplexus* and *rappardi,* we notice considerable differences in the shape of the hamuli and the vesicle of the penis. Yet, these structures do not afford good specific characters throughout the genus but they can be used as convenient group-characters. It is therefore safe to say that *saundersi* and *geometricus* for instance, as representatives of a different group, are quite distinct species.

Both *saundersi* and *geometricus* have been reported time and again from Sumatra but in most cases it was still a matter of some difficulty to decide to which of the two species the recorded examples should be attributed and to say precisely, from the descriptions and figures of the types, what value should be attached to certain differences which they presented. Here follows an enumeration of these Sumatran specimens:

1898. KRÜGER, Stett. ent. Zeitg. 59, p. 295 - 296. — ♂♀ Soekaranda (Deli) (*saundersii*).
1925. CAMPION, J. Fed. Mal. States Mus. 8, p. 162 - 163. — ♂ Sandaran Agoeng (Korintji) (*saundersii*).
1927. RIS, Zool. Meded. Leiden, 10, p. 29 - 30, 45 - 46. — ♂ Tamiai (Korintji) (*saundersi,* forma).
1932. FRASER, Mém. Mus. Royal d'hist. Nat. Belg. (hors série), p. 17 - 18. — ♂♀ Takengon (Atjeh) (*geometricus,* local race).
1935. LIEFTINCK, Misc. Zool. Sum. 92 - 93, p. 20 - 21, fig. 2. — ♂ Deli (*geometricus perplexus*).

With the exception of the Deli specimen, considered by me as a subspecies of *geometricus* SELYS, from Java, a correct identification of the above enumerated Sumatran specimens is impossible without re-studying them, but so much is certain that not only CAMPION's and RIS's individuals from Korintji (which in all probability are conspecific) but also KRÜGER's specimens from Deli (probably quite similar to the above mentioned ones), are fundamentally different from *geometricus* and its intimate allies.

The position of FRASER's local race of *geometricus* from Atjeh is uncertain; the male agrees in most respects with that of *geometricus perplexus* from Deli but differs in details of colouring. It has decidedly no affinity with *saundersi* and allies.

Lastly, our new species *rappardi* belongs to yet another species (or subspecies); it comes nearest to *geometricus perplexus* but differs from it by the black bands of the thoracic sides being broader (reduced to mere lines in *g. perplexus*), by the median yellow spot on abd.-segm. 2 being larger, extending

its full length, and by the spots on 3 - 4 being still narrower. The basal spots of segm. 3 - 6 are indented by black posteriorly, whereas in *g. perplexus* these marks are entirely divided so as to form paired spots. Moreover, the sup. anal apps. of *rappardi* are black-tipped, and the inferior one is entirely black, whereas in typical *geometricus* and *g. perplexus* the appendages are wholly ochreous or yellow, respectively. Lastly, we notice some slight differences in the form of the genital hamules and their bristles, while the anal apps. of *rappardi* are thicker, resembling more closely those of typical *geometricus* than those of *g. perplexus*.

The question arises whether *g. perplexus* might be regarded also as an independent species but this problem cannot be solved before a comparative study has been made of the remaining Sumatran representatives of this "cluster" of species, which I hope will soon be carried through.

Onychogomphus naninus (FÖRSTER) (fig. 29 - 30).

1905. FÖRSTER, Wiener Entom. Zeitg. 24, p. 19 - 21. — ♂ Than Moi, Tonkin (*Heterogomphus*).
1907. WILLIAMSON, Proc. U.S. Nat. Mus. 33, p. 314, 315 - 316 (not seen) (*Heterogomphus*).
1914. FÖRSTER, Archiv f. Naturgesch. 80, p. 75 (species transferred to *Onychogomphus*).
1922. LAIDLAW, Rec. Ind. Mus. 24, p. 414 (Not a *Heterogomphus*).
1930. LAIDLAW, Trans. Ent. Soc. London, 78, p. 192 (cat.) (*Acrogomphus*).

Material studied: — Tonkin: 1 ♂ (ad.), Mts. Mau Son, 3000 ft., H. FRUHSTORFER leg. (labelled by FÖRSTER on the paper cover: *"Het. nan.* ♂, Mau Son 3000'"), otherwise unidentified (no. 1846 of the Michigan University Museum).

Very similar in all respects to *O. aemulus*, sp. n., but it is a larger insect.

Agrees almost in every detail with the ample description as given by FÖRSTER. The type, which is in the Ann Arbor collection, is from the limestone-hills of Langson (Long Kuong River plain) near Than Moi.

Our paratype male differs from FÖRSTER's description in the following few points:

There is no yellow point on each side near the upper end of the antehumeral stripe (fig. 29); 5th abdominal segment also with a small, oval yellow spot on middorsum. In addition to the original description, it may be noted that the anteclypeus, in the paratype, is yellow, the postclypeus being wholly black (FÖRSTER: "Rhinarium und eind Punkt am Seitenrande des Nasus gelb").

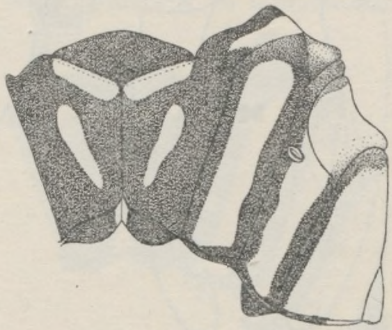

Fig. 29. *Onychogomphus naninus* (FÖRSTER), ♂ paratype, Tonkin. Colour-pattern of synthorax.

Venationally, this is a true *Onychogomphus*. The venation is identical to that of *aemulus*, except in the following respects.

Nodal index $\frac{10.16.16.10}{12.12.12.12}$. Bases slightly and very diffusely tinged with yellow. Area posterior to Cu_2 in hind wing a little broader, with three distinct side-branches between Cu_2 and A_1, the cells between them arranged in rows. About 3 - 4 marginal cells divided between the veins M_3 - M_4 and Cu_1 - Cu_2 in hind wing. Supplementary sectors between Rs - M_3 and M_1 - M_2 a little longer than in that species. Two rows of cells in the discoidal field of front wing to 2 cells beyond level of subnodus. Two rows of cells between M_1 and M_{1a} up to the distal end of pterostigma. Cross-veins between sectors of arculus to the bifurcation of M_{1-3} $\frac{2.2}{1.1}$.

Tıansverse ridge of frons better pronounced than in *aemulus*, rectangulate.

As appears from these notes, *naninus* should be placed in the same section of *Onychogomphus* as *aemulus*, *circularis* and *earnshawi*, and FÖRSTER was doubtlessly right in removing his species from *Megalogomphus* (*Heterogomphus* olim). It differs from *aemulus*, described hereafter, by its much greater size (abd. + app. 43, hw. 32.5, pt. 4 mm), the absence of a black stripe along lower margin of metepimerum, the much larger dorsal spots on segm. 3 and 4 of abdomen, and by the different shape of the genital hamules and the inferior appendage (fig. 30).

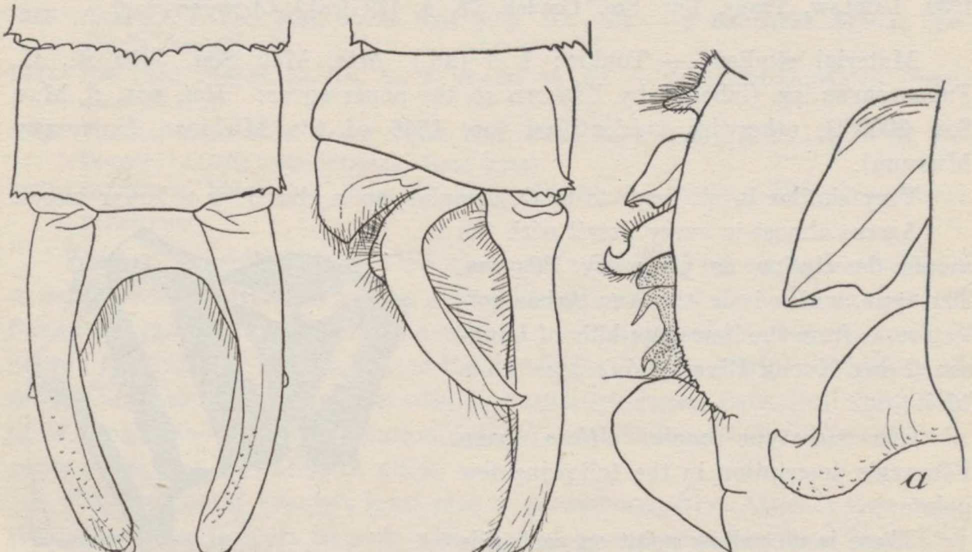

Fig. 30 *Onychogomphus naninus* (FÖRSTER), ♂ paratype, Tonkin. Anal apps., dorsal view and left side, and genitalia of second abdominal segment; *a*, hamuli more highly magnified.

I have neither seen specimens of *circularis* nor of *earnshawi*; the types of these species should be re-examined, and accurate drawings of the genitalia and anal appendages would seem to be of considerable assistance for a better under-

standing of relationships. Judging from the description of *circularis*, this would come very near to *naninus* (FÖRST.), and it may turn out to be the same species.

The female of *O. naninus* has not yet been described. Mrs. L. K. GLOYD, in a letter dated October 14, 1936, informs me that in the collection of the Michigan University Museum are one ♂ and one ♀ of *O. naninus* from Than Moi (Tonkin, leg. H. FRUHSTORFER), labelled by FÖRSTER "Type". She also writes me: "The ♂ and ♀ seem to be conspecific but a ♀ from Mau Son, also labelled "Type" by FÖRSTER, obviously does not belong to this species. The Mau Son ♀ is being sent to you for study".

This example bears the following labels in FÖRSTER's writing: Mau Son Berge, 3000 Fuss, Tonkin, H. Fruhstorfer/*Heterogomphus naninus* Foerster, Type ♀"; there is, besides, a label in Prof. KENNEDY's handwriting: "This ♀ is not conspecific with type ♀, C.H.K."

Judging from the venation and the form and armature of the legs this female is a species of *Merogomphus*, which does not concern us here.

Onychogomphus aemulus, sp. n. (fig. 31 - 32).

Material studied: — S. Sumatra: 2 males (ad.), Lampoeng Residency, Terbanggi-hilir near Menggala, August 18, 1936, MAX BARTELS jr. leg. Type and paratype in the Buitenzorg Museum.

Allied to *O. circularis* SELYS, from Upper Burma.

Black, marked with yellowish-green.

Male. — Labium greyish-yellow, the lateral lobes and the border of the median lobe bright yellow-green. Labrum black with two widely separated, oval, green spots placed on either side of the middle. Mandible-bases and anteclypeus green. Postclypeus black with a small, roundish, lateral basal green spot on either side, the strip between face and margin of compound eyes shining black. Frons with a transverse green band, constricted on middle, along upper margin, connecting the eyes but not touching the eye-margin, its anterior surface and base being black. Remainder of head jet-black. Occipital ridge simple, very slightly concave, fringed with brownish-black hairs.

Prothorax black, marked alternately with green, as follows: a mesothoracic collar interrupted in the middle line, and, connected with the collar, oblique antehumeral bands, rounded off dorsally and ceasing slightly before the ante-alar triangles, which themselves are black. No pale humeral line. Sides with three complete green bands: one on middle of mesepimerum, one on the metepisternum and a third on the metepimerum. The second lateral stripe widens ventrally, covering most of the metinfraepisternites, and, before

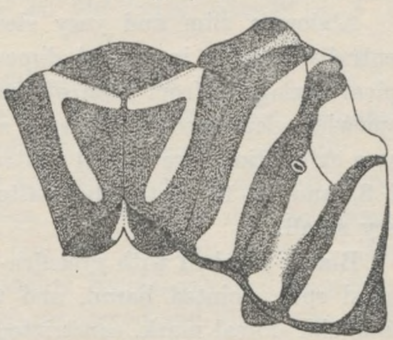

Fig. 31. *Onychogomphus aemulus*, sp. n. ♂ paratype. Colour-pattern of synthorax.

its dorsal end, shows a tendency of being obliterated (fig. 31). Venter of thorax pale greyish-yellow. In the paratype male, the antehumeral green stripes are separated from the mesothoracic collar for a short distance and taper to a point ventrally; moreover, the second (metepisternal) green stripe is not noticeably obliterated before its dorsal end.

Coxae pale greenish-yellow. Legs short, black: inner surfaces of all femora with a green stripe, widest on middle. Armature as for genus.

Wings with a greyish-yellow tinge all over the membrane, and with more distinct brown rays in *sc* and *cu* to level of the first cross-veins in these spaces. Neuration typically Onychogomphine, black including the costa. Pterostigma black, braced, covering five cells. Nodal index $\frac{10.15.16.10}{10.11.11.10}$ (type), $\frac{10.16.17.11}{11.12.11.12}$ (paratype). Anal triangle four-celled, tornus prominent; the vein A_3, where it forms the inner margin of the lower cell of the triangle, finely denticulate. Anal loop irregular, two-celled; one row of cells between A_3 and the loop, the marginal cells divided. Anal area of front wing with a single row of cells but one or two cells divided. Branches of Cu_2 tend to take on a pectinate arrangement in front wing, with one (basally) or 2 - 3 (distally) cells between Cu_2 and the margin; three rows of cells between Cu_2 and the margin in hind wing. Cu_1 and Cu_2 in front wing running parallel up to level of nodus, thence strongly divaricate with 4 - 5 marginal cells between them; in hind wing also parallel but with the last two or three marginal cells divided. Discoidal field in front wing with two rows of cells to well beyond level of subnodus. M_3 and M_4 parallel, only slightly divaricate at the wing-margin, 3 cells between them at their distal ends in front wing, 2 - 3 cells in hind wing. Supplementary sectors between Rs and M_3 and between M_1 and M_2 distinct.

A single row of cells between M_1 and M_{1a}, except that the 2 to 4 marginal cells are divided. Cross-veins between sectors of arculus to the bifurcation of M_{1-3} $\frac{2.2}{1.1}$ (holotype), $\frac{3.2}{1.1}$ (paratype).

Abdomen slim and very slender. Basal segments rather inflated dorso-ventrally, less so in lateral dimension. Segm. 3 - 6 very thin and cylindrical, apical segments, from base of segm. 7 to end of 8 rather much widened and somewhat depressed; 8 - 9 with a distinct exfoliation of the lateral margins, these exfoliations are turned ventrad and not visible from above; apical portion of 8, and 9 - 10 distinctly flattened dorsally; segm. 9 shorter than 8, 10 very small.

Black; marked with greenish-yellow, as follows. Segm. 1 with a triangular dorsal spot, pointed basad, and with the sides largely green; 2 also with a triangular dorsal mark, constricted on the middle and pointed apicad, the sides being green with the dorsal black protruding laterally on middle of segment behind the auricles, which are green with a narrow black margin. Auricles circular, with 3 - 4 small marginal posterior teeth. Genitalia, including the seminal vesicle, black. Segm. 3 with a complete basal ring, occupying about one-seventh and with an isolated, oval, longitudinal dorsal spot, placed about

the middle of the segment. On segm. 4 - 5 the basal ring is a little smaller and interrupted on mid-dorsum, but on 6 it is again larger, occupying about one-fourth of its length, though likewise interrupted mid-dorsally. On segm. 7 the yellow ring is complete and cut off straight posteriorly, occupying the basal two-fifths of the segment; 8 - 10 unicolorous black. In the paratype male each of the segments 4 and 5 bears an additional, though small, oval, yellow spot placed mid-way the length of each segment.

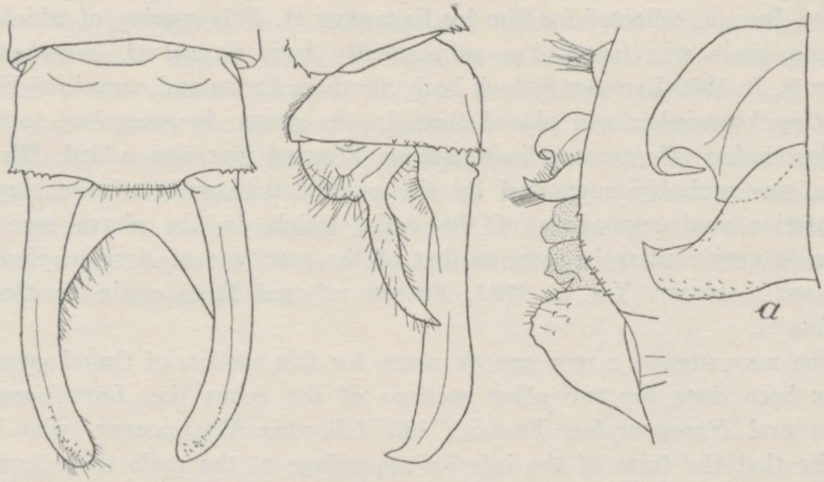

Fig. 32. *Onychogomphus aemulus*, sp. n. ♂ paratype. Anal apps., dorsal view and left side, and genitalia of second abdominal segment; *a*, hamuli more highly magnified. (Figs. 30 and 32 are drawn to the same scale).

Genitalia: anterior lamina transverse, very small and well rounded; anterior hamule prominent, shining black, broad and strongly ridged laterally, end-hook well developed, acute, abruptly curled inwards and upwards; posterior hamule acutely pointed, black, of equal length, slightly twisted, evenly curved forwards and a little inwards. Vesicle of penis of moderate size, black, shaped as in fig. 32. Genital lobe represented on the tergal margin by 5 - 6 short black teeth.

Superior anal appendages black, cylindrical, more than twice as long as segm. 10, simple, slender, slightly curved toward each other, apices rounded in dorsal view, the dorso-lateral keel low, minutely denticulate apically; in lateral view evenly widened after their middle and finally again narrowed and abruptly curved downwards, with pointed tips. No inferior denticulations. Inferior appendage black, a little more than one half as long, broadly bifid for more than two-thirds of its length, the branches simple, rounded, tapering, widely and continuously divaricate, apex slightly upcurved and bluntly pointed (fig. 32).

Length: abd. + app. 36 (type), hw. 28, pt. 3.2; 36, 28, 3.0 (paratype) mm.

Female unknown.

This new species, by the peculiar shape of its anal appendages, stands somewhat isolated among the more typical members of the genus. Venationally,

O. aemulus is a true *Onychogomphus,* and comes nearest to *O. circularis* SELYS, *O. earnshawi* FRASER, and *O. naninus* (FÖRSTER), with which it forms a group or section within the genus, which is characterized by the weak forms and hypertrophied condition of the anal appendages of the male; especially the widely divaricate inferior one being noteworthy, a shape otherwise quite unique in the genus. This modification of the normal type was first recognized by WILLIAMSON, who described an *Onychogomphus ? species* from the Toungu districts, Burma, collected for him by EARNSHAW [1]). This species, of which only a single male was found, has subsequently been named *O. earnshawi* by FRASER [2]). In 1930 LAIDLAW [3]) took both *circularis* SELYS and *earnshawi* FRASER from *Onychogomphus* and placed them in the genus *Acrogomphus,* to which *Megalogomphus* (*Heterogomphus*) *naninus* FÖRSTER was also added. His suggestion was probably supported by the evident uniformity of the shape of the inferior anal appendage of the male, which, in the above mentioned species, is very similar in form to that of the genotype of *Acrogomphus,* viz. *A. fraseri* LAIDLAW. Yet, it 1934, FRASER referred them again to *Onychogomphus* [4]).

One may suggest a new generic name for this section of *Onychogomphus,* as has been done for two other sections of the genus (i.e. *Lamelligomphus* FRASER and *Nepogomphus* FRASER), but following WILLIAMSON, who justly remarks that the form of the inferior appendage of the male throughout the genus *Onychogomphus,* even in its restricted sense, can hardly be defined as of one type, it would seem to me that *circularis* as well as *earnshawi* should better remain in *Onychogomphus,* to which *naninus* and our new species *aemulus* are now also added. For, opposed to the weak negative evidence of the form of the inferior appendage against referring *aemulus* and allied species to *Onychogomphus,* is the very positive evidence for such a relationship shown by the venation.

On comparing our new species with *Acrogomphus walshae* LIEFT. [5]), and *fraseri* LAIDLAW, the only two species of that genus I have been able to study, we notice that in *A. walshae* there are 4 cross-veins between the sectors of the arculus to the bifurcation of M_{1-3} in the front wings, 3 in hind wings. As has been pointed out by WILLIAMSON and LAIDLAW, the "spacing-out" of the cross-veins between M_{1-3} and M_4 is *the* character which differentiates the two subfamilies *Epigomphinae* and *Gomphinae;* this character in *O. aemulus* and *naninus* is exceedingly characteristic, while in *A. walshae* it is as unapparent as in *A. malayanus* LAIDLAW; in *A. fraseri* LAIDLAW it is apparently somewhat variable (number of cross-veins 3 - 5 in front wing, 1 - 3 in hind wing). *O.*

[1]) Proc. U.S. Nat. Mus. 33, 1907, p. 313 - 315, fig. 29/14 (thor.), 37 (wings).
[2]) J. Bombay Nat. Hist. Soc. 30, 1924, p. 113 - 114 (Indian Dragonflies, pt. 19).
[3]) Trans. Ent. Soc. London 78, 1930, p. 191 - 192.
[4]) Fauna of British India, Odonata 2, 1934, p. 261 - 265.
[5]) There is an evident *lapsus calami* in the name of this species as first published: it was named unintentionally *A. walshi* instead of *walshae,* although I gave an explicit derivation of the name; the error is quite evident and the emendation appears to be allowed and necessary.

aemulus and allies should therefore be placed in the *Gomphinae, Acrogomphus* in the *Epigomphinae.*

In addition to the venational character just mentioned, our South Sumatran *Acrogomphus walshae* differs from *Onychogomphus aemulus* and *naninus* very markedly by the shape of the fork of the median vein. In *A. walshae* (and, as appears from LAIDLAW's photograph of the wings, in *A. malayanus* as well), the forking of M_{13} is distinctly *unsymmetrical* (c.q. course of M_3 straight in both wings), whereas in *O. aemulus* and *naninus* the fork is symmetrical (c.q. M_3 curved at origin). So far as I am aware at present, the unsymmetrical condition of the common stem of M_{1-3} is a primitive character, and is best pronounced in such genera as *Leptogomphus* and *Heliogomphus,* i.e. in the more primitive genera of the oriental *Epigomphinae*. On the other hand, in the species of *Onychogomphus* examined by me, the symmetrical forking of M_{1-3} appears to be a constant character. In this point also the *circularis*-group of *Onychogomphus* shows a closer resemblance to the *Gomphinae* than it does to the *Epigomphinae.*

SECOND CONTRIBUTION TO A STUDY OF THE TROPICAL SOIL AND SURFACE FAUNA.

By

Dr. K. W. DAMMERMAN

(Buitenzorg Museum).

The first contribution to this subject by the author appeared more than ten years ago [1]); some explanation for the long interval will, therefore, not be out of place.

The method described in my first paper, although giving comparatively reliable results, proved to be rather unsatisfactory, for in spite of the extensive labour with which the investigations are attended the results are too indefinite and too liable to variation. Another drawback is that a more detailed study is almost excluded owing to the fact that many of the species and even whole groups of animals brought to light by our researches remained unnamed, as the great bulk of the material collected consists of very small species or belongs to groups very hard to get identified by any specialist.

The investigations have been continued during a long period but we abandoned the more systematic researches practised during the preparation of our first paper and restricted ourselves to incidental researches when coming upon rather deviating habitats, or visiting some outlying localities.

With this paper we will conclude our investigations on the tropical soil and surface fauna. All results now under discussion were obtained by the same method as adopted in my first contribution (Treubia VI, p. 107).

1. The total number of species and individuals found on one square metre.

In my first paper I accepted an average of 25 species living on 1 m^2; now, by calculating the mean figure for all localities examined it proves to be 24 (See Synopsis B. p. 139). These figures have some value owing to their agreement, notwithstanding the fact of the entirely different habitats and localities having been investigated before and after 1925, the year when the first contribution was published.

As to the number of individuals found on the same area the average comes to 90 specimens or nearly 4 individuals pro species (ants and termites are excluded, these being groups of which the number of species only has been ascertained).

These figures are rather low but one has to keep in mind as already mentioned that the numbers are not exact, the method practised revealing only a part of the whole biocönosis living on a certain area.

[1]) Cfr. Treubia Vol. VI, p. 107.

Below this average there remain still the figures obtained for the KRAKATAU ISLANDS in the Sunda Straits (Krakatau proper and Verlaten I.) The numbers, resp. 18.7 and 13.8, seem to indicate a little improvement during the lapse of time between our first investigation made on these islands and later on (1920 and 1933). But this improvement is mainly due to the surface fauna of the Casuarina (chemara) forest on both islands having become apparently richer in the period under consideration, whereas in the virgin (mixed) forest on Krakatau this fauna remains practically constant; on Verlaten I., however, a decline has been established.

The figures have become more uniform. The present investigation yielded one case only of less than 10 species to 1 m^2 whereas previously six were recorded. On the other hand our earlier records include five cases in which more than 20 species were collected, whereas now only two such cases occur. All the other places gave figures between 10 and 20.

In calculating the above-mentioned averages we have excluded nos. 18 and 19 of Appendix C relating to a part of devastated forest.

In July 1930 very heavy eruptions lasting for several weeks burst forth from the new volcano, Anak Krakatau, which some three years back rose from the ocean floor in the midst of the three islands of the Krakatau group. By these outbursts a part of Verlaten I. was covered by a layer of very fine volcanic ash causing the leaves to fall and killing the young twigs and buds and to a great extent the lower undergrowth. When we visited the island about a week after the last explosions the devastation was very clearly to be seen, the whole forest looking like a landscape in wintertime or as though destroyed by fire. On the northern part of the island the line of demarcation between the devastated and the unruined sections coincides closely with the boundary between the mixed forest south of the lake and the Casuarina forest north of it; this Casuarina forest remained practically undisturbed by the ash-tornado.

In a future paper dealing with the fauna of the Krakatau islands we will discuss in detail the influence of such volcanic action upon the fauna as a whole, but here I will restrict myself to its influence upon the surface fauna.

During our short stay we were able to examine four places: one in the midst of the devastated region (No. 18 of our list), one on the border (No. 19), one outside the ruined area, but still in mixed forest (No. 20) and one in the chemara wood (No. 21).

In the devastated forest the influence of the volcanic action was very conspicuous: here only 7 species could be found on 1 m^2 and no more than 12 individuals, all the softer and more delicate animals, such as the larvae of Diptera and moths, spiders, mites and molluscs, even bugs and myriopods had disappeared. On the border the number of species and individuals became doubled; a single bug and a few spiders and one other arachnoid, a Pseudo-scorpionid, had to be added to the animals escaping destruction.

In the apparently untouched mixed forest no higher number of species could be detected, the only new element being a species of mollusc. But the

number of specimens reached a much higher level resulting in about 10 individuals pro species. In the Casuarina forest, however, the number of species on 1 m^2 increased to 20 and that of individuals to 211. Here representatives of several new groups came upon the scene: earwigs, myriopods and mites.

In our researches later on when the mixed forest seemed to be wholly restored we could not discover on the average very many more species and individuals, except in one case (No. 24), caused by the finding of an extraordinary number of woodlice.

If we compare the results of our second investigation of the Krakatau islands with those made previously (1919-'20) we find only a rather conspicuous reduction in the number of beetles (Staphylinidae, Pselaphidae and Tenebrionidae) and molluscs. On the other hand the number of ants and arachnoids, mainly spiders, has increased and even some groups formerly not represented, such as myriopods, mites and Oligochaeta (Enchytraeids), are now recorded for the first time.

These changes in the faunal elements of the mixed forest can hardly be ascribed to the influence of volcanic action as there is an augmentation of the last-named groups and the spiders, groups which, as has been demonstrated above, are most liable to be affected by volcanic ashes, whereas on the contrary the more hardy beetles have diminished.

There is, however, some improvement in so far as some groups not found in 1919-'20 have now been brought to light as elements of the surface-fauna.

On Krakatau as already mentioned the number of species in the mixed forest remained practically constant. But here again we find also a rather strong decline of Coleoptera (Carabidae, Staphylinidae, Pselaphidae, Tenebrionidae), bugs and molluscs, whereas there is found an increase in the number of species of ants, lepidopterous larvae, and spiders. The only group making its appearance as a new element of the forest-floor fauna is the earwigs.

The decline of nearly the same groups of animals on Verlaten I. as well as on Krakatau, which latter island remained undisturbed by the eruptions of the new volcano, is the reason we cannot ascribe this reduction to volcanic action. It may be that the keen competition of ants has something to do with the falling-off in the number of beetles, both groups arriving at a more normal proportion in regard to each other.

In the Casuarina forest on Krakatau we established the same fact: a strong increase of ants coinciding with a decline of the beetles; but in the same type of forest on Verlaten I. both groups have increased, although the Coleoptera in a far less degree than the ants. On both islands in this kind of biotope there are some groups which reveal a noteworthy augmentation, e.g. myriopods and spiders.

We have to bear in mind that all that has been mentioned previously relates to the number of species and not to the number of individuals. As to the latter we observed on both islands a decrease of the number of specimens. On Krakatau, taking the surface-fauna as a whole, the proportion of individuals

to species shifted from 3.3 to 3; in the virgin forest, these figures were 3.4 and 2.2. On the other hand in the Casuarina forest this proportion increased from 2.7 to 4.2, one exceptionally rich finding, (No. 16 of our list), in which a large number of woodlice and spiders was found, being mainly responsible for this increase.

On Verlaten I., however, we achieved somewhat opposite results, the whole surface-fauna falling off from 12 to 9 specimens pro species and that of the Casuarina forest from 18 to 5; but here the virgin forest shows an increase from 9.2 to 13, this being almost entirely due to the very high numbers of woodlice collected in all cases.

At DEPOK, a small village situated half-way between Buitenzorg and Batavia, a small area of forest has been preserved since 1913, surrounded by a fringe of bush in which the useful wood is regularly cut. [1]) The object was to ascertain whether there exists a difference between the surface-fauna inside and outside the nature-reserve, and whether there will be an improvement in this respect inside the reserve after a lapse of some years of preservation.

Our former investigation in this locality, which took place mainly during 1923, brought to light some difference to the advantage of the reserved forest. In 1930, seven years later, there is still some difference although it is a very slight one. But contrary to our expectations both inside the nature reserve and outside it the number of species as well as of the individuals has been reduced to about half that found formerly.

The Coleoptera have decreased the least, nearly all other groups showing on the other hand a considerable reduction in species as well as in individuals, especially ants, blattids, arachnoids and molluscs. A remarkable feature too is the almost complete disappearance of bugs, earwigs and myriopods. We have no definite idea what may be the cause of these contradictory results but I think it may be the very wet wheather during the months of February and May of 1930, when our investigation took place (See table).

Rainfall (in mm) of Depok.

	Jan.	Febr.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
average	340	324	302	313	257	184	125	137	198	263	336	281
1923	198	272	205	171	212	321	301	0	35	49	325	290
1930	86	348	293	407	390	92	102	66	124	166	356	128

The great humidity probably has been not only unfavourable to the detritus fauna itself but also detrimental to the method adopted by us. The material to be sifted, especially the soil, being too wet, clotted together, enwrapping many species and crushing others.

The surface-fauna at the IDJEN-MASSIF in East Java proved to be rather rich. By excluding divergent habitats, like the nearly bare volcanic mass, the

[1]) For more particulars see Treubia VI, p. 113.

grass and moss-covered places, we find in the forest between 950 and 1400 m, an average figure of about 50 species and 180 individuals on 1 m^2, the maxima being respectively 66 and 258. These numbers, although being twice the total average, remain below those compiled for Tjibodas at about the same elevation in West Java, where the figures are 60.9 and 88 species, the highest records observed, and 237 and 505 specimens. But the forest at Tjibodas is a very luxuriant mixed jungle, the forest on the Idjen on the other hand being poorer and differentiated by the more monotonous chemara woods.

Going higher up the mountains we observe in both localities a reduction in the number of species, at the same time the dissimilarities becoming less. The number of individuals is still high and on Mt. Gede in the forest above Tjibodas at an altitude of 2400 m the highest figures ever recorded are found, this, however, being chiefly caused by an extraordinary number of small molluscs living here among the vegetable debris.

The main feature of the higher altitudes is the gradual disappearance of certain groups: termites vanishing at about 1400 m and ants at 2000 m as elements of the surface-fauna.

Our records from two coastal islands in the Java Sea, KARIMON JAVA and BAWEAN, the one lying off the coast of Central and the other of East Java, give evidence of a rather poor surface-fauna the numbers remaining far below the average. On these islands this particular fauna is only a trifle richer than that on the barren coral islands in the Batavia bay.

At SUMBA, an island situated west of the Timor archipelago, the most outlying locality in which we collected data, the forest-floor fauna varies in the number of species about the total mean figure, the number of individuals remaining far below the average. We are dealing here with that island-chain the fauna of which becomes poorer and poorer in proportion to the distance from Java.

As to the number of individuals (excluding ants and termites) some very low figures, less than ten, have been recorded from a few localities only, e.g. from Durian and Depok. In other instances such faunal poverty is exhibited only in some extreme habitats, such as rocky mass or moss-vegetation at 1700 m on the Idjen massif or grass wildernesses on Sumba. As a matter of course these low figures concerning specimens are correlated with the lowest numbers of species found on 1 m^2, the minimum being four species yielded by the above mentioned moss-vegetation on the Idjen mountains. Here one species of ant, one Coleopteron (a Staphylinid) and two species of spiders were brought to light.

2. The influence of soil and vegetation.

Soil and vegetation are so intimately connected with each other that we propose to discuss their influence on the detritus fauna at the same time. This fauna is mainly dependent on the richness of vegetable debris and the formation of mould, both being formed best and to the largest extent by the tropical primeval forest, the real tropical jungle composed of numerous varieties of

trees and plants. The richest layers of mould we find in the mixed forest on a fertile volcanic soil higher up the mountains where the disintegration of the vegetable litter progresses at a slower rate than in the lowlands. As our researches did not include enough experimental places at different altitudes we cannot give an opinion on the optimum elevation at which the richest humus and consequently the richest soil and surface-fauna is to be found. For the moment we have to restrict ourselves to remarking that the most abundant finds are recorded from the mixed forest at Tjibodas at an altitude of 1400 m with an average of nearly 61 and a maximum of 88 species on 1 m^2. Hardly less are the figures for the same type of forest on the Idjen with an average of nearly 50 and a maximum of 66 species. Also in these localities the number of individuals is high although not exceeding the normal proportion of 4 specimens to 1 species. As to the different elements of the surface fauna almost all groups are well represented here except termites and Tenebrionids.

The first-named insects stop their activity at higher altitudes whereas the Tenebrionids are more adopted to less humid habitats. It is not a question of altitude, for on the Idjen mountains representatives of the latter family, not having been recorded from the surrounding forest, were present again on the nearly bare rocky mass, a very arid spot without any mould.

Next to these rich mountain habitats comes the virgin forest of the lowlands but wherever this forest shows a more secondary character owing to the poor and unfertile soil the figures fall below the average. Thus on Durian, Karimon Java and Bawean, all three islands consisting of old denuded rock, the number of species on 1 m^2 does not even reach twenty, the number of individuals being only one and a half times the number of species, or even less than that. The surface-fauna of these islands is rather poor in Staphylinids, bugs and earthworms and striking by the total absence of Lepidopterous larvae.

We have already mentioned something of the difference between the surface-fauna of the mixed forest and the Casuarina forest on the Krakatau islands; moreover the conditions here being not yet normal, we will turn to these types of forest on the Idjen.

In the total number of species and individuals we find hardly any difference at all, but the Casuarina forest seems to be somewhat richer in beetles, bugs and earwigs, whereas in the forest of foliage-bearing trees Aptera, myriopods and earthworms prevail.

The last biotope we have to take into consideration is the grassy plain. On the Idjen massif we examined only two samples of this kind of soil-covering which show figures far below the average especially with regard to the number of specimens. Concerning the different elements of the surface-fauna there is some lack of beetles, Aptera, myriopods, molluscs and earthworms, this type of vegetable growth being remarkable too by the absence of woodlice, a group of animals otherwise represented nearly everywhere.

On Sumba we established the same fact of the poorness of the grassy plain as compared with the true forest. Also with reference to the various

elements of the surface-fauna we find a decrease of the same groups as mentioned above, with the exception of the beetles, the latter group showing an average of 4.1 species on 1 m^2 against 4.7 in forest-clad places.

3. The surface-fauna and its components.

The surface or detritus-fauna is mainly composed of two groups of animals: scavengers and predatory ones. The majority of the elements of this biocönosis belongs to the first-named group. The larvae of Diptera and Lepidoptera, termites, Aptera, Crustacea, molluscs and earthworms and other Oligochaeta, all live on the vegetable mould covering the soil. Some groups such as the termites, members of the Orthoptera, and some lepidopterous larvae, crustaceans and molluscs attack the vegetable litter in a less desintegrated state, even wood and freshly fallen leaves being occasionally devoured.

Other groups are not uniform in their mode of life, so that among the beetles the Tenebrionids, the weevils, many Staphylinida, the Lamellicornia and Elateridae and the main bulk of the so-called micro-coleoptera feed on decaying vegetable matter. The Heteroptera or bugs, the Orthoptera, myriopods and Arachnoidea include both carnivorous and saprophytic species.

The sustenance of some other species consists of the fungous growth found abundantly in the humus. Specially adapted to this kind of food are some polyphagous and clavicorneous beetles and many mites.

Essentially predaceous on the other hand are the great majority of the ants, the Carabidae, a number of Staphylinids too, the Reduviidae, and some members of a few other families of minor importance, among the bugs, the Chilopoda, the spiders, various species of mites and the Pseudoscorpiones and the Opiliones among the Arachnoids.

Both groups are subject again to attacks by parasitic animals, such as Hymenoptera parasitica, but their presence is very seldom rendered evident by the method that we practised.

Hymenoptera.

As already mentioned other Hymenoptera than ants do not play an important part in the faunal element of the forest-litter. In our previous paper we remarked on the occurrence of parasitic Hymenoptera in 3 percent. only of all our researches. In our new series of investigation we came across only one such insect. Now certainly a great number of the animals occurring on the soil is liable to be attacked by parasitic wasps, but the adult insects seem to be found rarely among the vegetable debris in search of their hosts or else they escape readily from the material gathered together before it has been investigated.

Ants on the other hand are one of the most constant components of the detritus-fauna and are represented in the most divergent biotopes. In no more than 12 percent. of our discoveries were they found missing. As already mentioned they are not met with, at least as an element of the surface-fauna, above

about an altitide of 2000 m, but otherwise species are only wanting in abnormal habitats like Krakatau, or in poor localities such as small islands like Karimon Java.

The mean number of species found on 1 m² is 3.3 the maximum being 7, which figure is recorded from Durian, Krakatau and Sumba. Formerly mention has been made of much higher numbers from the same area as no less than 13 species were once found at Depok and 11 at Tjibodas.

As to the different species we often observe ants on the soil, which cannot be reckoned as belonging to the true detritus-fauna, as they are occasional visitors only, wandering to or from their nests. Even such a typical ground-loving species as *Plagiolepis longipes* does not pass its whole life among the detritus of the forest-floor. Such a mode of life is probably only exhibited by a number of very small species which live in concealment among the leaves and nest in the ground, finding all the necessary food in this particular secluded spot. As representatives of this peculiar group we may mention in the first place the genera *Ponera, Euponera* and *Prenolepis*. Also often found among forest-litter are *Pheidole megacephala* F., a well known harvesting ant, the soldiers being characterised by their enormous heads, and the very minute *Monomorium pharaonis* L., a cosmopolitan species.

Other species are conspicuous on account of the rugosely sculptured upper surface of the body, like *Tetramorium guineense* F. (fig. 1).

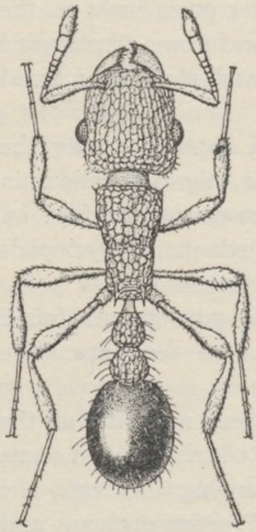

Fig. 1. *Tetramorium guineense* (× 20).

Coleoptera.

Beetles are found in nearly the same percentage as the ants, being present in 87% of our researches. But they are not so ubiquitous as the last-named insects although they can be collected up to the summit of the highest mountains. There are a number of localities with places where no beetles can be found as on Durian, Krakatau, Verlaten I., Karimon Java and Bawean.

The number of species on one square meter is on the average 4.3, the maximum 29, which number we found in the rich forest-fauna of the Idjen plateau at an elevation of 1400 m, the same maximum having been recorded formerly from Tjibodas at the same altitude.

The richest locality is again the mixed forest on the Idjen mountains with reference to the number of specimens found on 1 m² with a maximum of 61 and an average of 31 beetles against a mean average of only 8.3.

Far below the average both of species and individuals remain still the Krakatau islands, Karimon Java and Bawean.

Carabidae are not numerous in our samples, as in less than 40 % of our researches did we come across members of this family. Also the maximum

number of both species and individuals is low, being resp. 4 and 6. Both these maxima were found on the Idjen mountains in mixed forest at 1400 m altitude.

A remarkable fact worth mentioning is that formerly (1920) Carabids were very seldom missing in our samples from Krakatau I. whereas during our last investigations they were wholly absent; on Verlaten I. Carabids are not seldom found on the forest-floor. Also from the Karimon Java islands members of this beetle family are not recorded.

Ground-beetles do not display in the tropics such a variety of forms nor reach as a rule such a size as in temperate regions, the majority of the species being small and inconspicuous. An exception is *Catadromus tenebrioides* OLIV., a large black beetle of 55 mm length which was sometimes brought to light. Among the smaller species we may mention the members of the genus *Trichotichnus, Patellus drimostoides* CHAUD. and the metallic green *Catascopus elegans* WEB. (fig. 2).

Fig. 2. *Catascopus elegans* (× 4).

The *Staphylinidae* or rove-beetles play a much more important part as an element of the detritus-fauna than members of the foregoing family, being recorded in about 60 percent. and present in all localities and at all altitudes. The maximum number of species found on 1 m^2 was 14, this figure being yielded by the virgin forest on the Idjen massif at an elevation of 1400 m, the highest number of specimens, 56 being found in the same biotope but higher up the mountains at 1850 m. During our previous researches the maximum number of species, 11 recorded from Tjibodas, comes quite near the figure mentioned above, but then a much larger number of individuals was found in one sample from Tjibodas, no less than 238 rove-beetles being counted once on one square meter.

With reference to the different species the Staphylinidae are such a characteristic group among the special kind of animals with which we are dealing that it is hardly possible to enumerate all the genera represented among the forest-litter.

Pselaphidae are not an unusual component of the surface-fauna, formerly 39% of our samples yielded members of this family now being met with in only 26%. Whereas during our previous researches a maximum of 6 species and 41 specimens on 1 m^2 was recorded from Depok, now these members do not reach higher figures than resp. 4 and 7, found in the same locality. On Karimon Java and Bawean these beetles were altogether absent.

The presence of Pselaphids is not always correlated with the occurrence of ants in association with which, however, many species do live. From altitudes where ants are absent these beetles are still recorded proving that some species at least are not myrmecophilous, a fact emphasized already in my previous paper.

Few of the species have been worked out, but the great bulk of the material still remains to be named.

The *Tenebrionidae* are represented in our findings in about the same percentage as the Pselaphidae. These beetles usually abound in dry and arid places therefore none was collected in the humid floor-covering of the virgin forest on the Idjen mountains just as was the case with the moist forest of Tjibodas. But also on Karimon Java their absence is a noteworthy feature. Remarkable too is the richness of the Krakatau islands in this group of beetles, from Krakatau itself they were recorded in 40% of our samples, and from Verlaten I. even in 60%. Also on the latter island the maximum number both of species and specimens on 1 m^2 has been found, viz. 2 species and 7 specimens. Formerly in 1920 a much higher maximum of individuals, that is 36, was observed. I suppose, however, that in the long run this special element of the fauna on the Krakatau islands will attain a more normal proportion as the vegetation and forest-floor covering becomes moister and richer in mould.

The same maxima of species and individuals as mentioned above for Verlaten I. are recorded too from Sumba, an island also characterised by its arid nature.

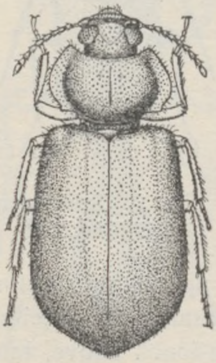

Fig. 3. *Pseudolyprops forticornis* FAIRM. (× 5).

Representatives of a great number of genera are to be collected, such as the rather bulky *Heterotarsus inflatus* LAC.; most of the other species are inconspicuous dull creatures belonging to the well-known genus *Gonocephalum* or to *Uloma,* both with a large number of species. More striking by the dense covering of hairs are the species of *Pseudolyprops* (see fig. 3).

Weevils or *Curculionidae* are a rare feature among the surface-dwelling animals; this time they were only met with in some numbers on the Idjen-plateau. Here they were not bound to a special habitat being found as well in the forest as in grassy fields or on rocky mass.

As to the remaining families of the Coleoptera representatives of a few more should not be passed over without mention. In the first place *Scydmaenidae* are not an unusual element of the detritus-fauna, the species of which family bear some resemblance to the Pselaphids and are often found in company with them. Also *Elateridae* or click-beetles are not rare but here it is mainly the larvae only and seldom the adults which are seen. Even more abundant than species belonging to the two above mentioned families are the very small beetles belonging to that large group of polymorphous Coleoptera with which is reckoned also the family of the Scydmaenidae. Little more can be said of these tiny creatures as it proved to be quite hopeless to get these microcoleoptera identified.

Diptera.

Dipterous larvae are not such an essential component of the surface-fauna, their percentage not attaining a higher figure than 20. But as already pointed out in my previous paper this low percentage is certainly partly due to our

method of research not being suitable for the collecting of these delicate animals. Drier or more unfertile localities, such as Depok, Karimon Java, Bawean and Sumba, are characterised by the absence of this kind of larvae which on the other hand in the luxuriant forests of the higher altitudes is seldom missing in our findings. On the Idjen mountains the grassy plains harboured the maximum numbers of species and individuals.

Lepidoptera.

Whereas probably surface-dwelling lepidopterous larvae are less numerous than dipterous larvae our special method of investigation revealed more often the occurrence of the first named insects. Their total absence was stated for such ppor islands in faunistic respects as Durian, Karimon Java and Bawean.

Not more than two species at the same time were now counted on an area of 1 m^2 this being far less than the maximum number of 6 species formerly recorded from Tjibodas.

Rhynchota.

Among the Rhynchota it is only the *Heteroptera* or bugs which form an important part of the tropical surface-fauna, being recorded in about 60% of our samples. Their total absence was only noticed on the Karimon Java islands. The highest number of species on 1 m^2 was 7 and the highest number of specimens 61, both figures furnished by material collected in the forest on the Idjen at an altitude of 950 m.

The surface-dwelling bugs belong to two groups, viz. the true detritus-forms and raptorial species. Of the first-named group we should mention the small species of the Lygaeid genus *Cligenes* (see fig. 4) which are often met with and not infrequently present in some abundance. Another characteristic ground-dwelling bug is *Eumenotes obscura* WESTW. with a peculiar broad head armed with spines.

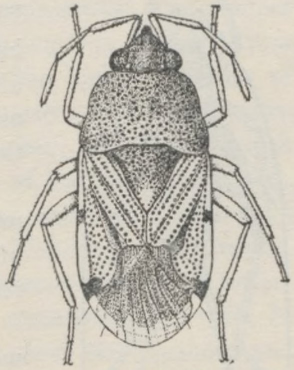

Fig. 4. *Cligenes signandus* (× 17).

The predatory species are mostly *Reduviidae* but sometimes also species of other families such as the *Henicocephalidae* are observed. A remarkable Reduviid conspicuous by its deep blue colouring and red markings, *Ectrychotes* (see fig. 5), an unusual feature among such animals living in dark and hidden places, has been collected on Krakatau in some numbers.

Other groups of Rhynchota made themselves only seldom apparent during our investigations. Once a Coccid was brought to light but here we are dealing certainly only with an occasional visitor of the habitat under consideration, or a root-sucking species from deeper layers.

Orthoptera.

Orthoptera constitute an essential element of the detritus-fauna coming in percentage of occurrence only a little behind the ants and beetles. They have been collected in 72% of the spots examined, being represented in all the localities. Six species, the maximum number observed on 1 m^2, and 54 specimens, the highest number too, were found in the Idjen forest at 950 m.

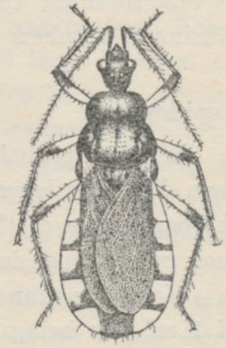

Fig. 5. *Ectrychotes coloratus* MAYR (× 3).

It is mainly the two families of *Blattidae* and *Forficulidae* which furnish the elements of this special biocönosis. The Blattidae or cockroaches are to be mentioned in the first place being found abundantly in vegetable debris. Their absence was noticed in less than 40% but this only so far as certain places are concerned, being met with in all localities investigated. There are only two localities which proved to be poor in this catagory of insects, viz. Depok and the grassy plains at Sumba. On Karimon Java the highest number of species, 5, was counted, the highest number of individuals being 26 which number is recorded from the forest at an elevation of 1850 m on the Idjen massif.

Except the species already mentioned in my previous paper (*Pycnoscelus surinamensis* L. and *Rhicnoda rugosa* B. v. W.) it is chiefly *Blatta orientalis* L. and the apterous *Stylopyga picea* BRUNN. which were collected from forest-litter.

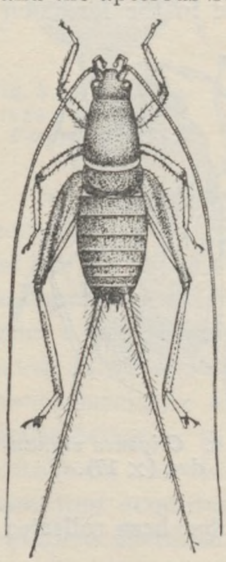

Fig. 6. *Cycloptilum majus* (× 2).

Forficulidae, the earwigs, are far less numerous than Blattids, here the percentage is nearly the inverse they having been recorded in less than 40%. These insects are also far from ubiquitous like the cockroaches, as there are a number of localities where we did not come across them: Verlaten Island, Depok, Karimon Java.

Three species and 39 specimens from one square metre, both maxima were observed again in the forest of the Idjen mountain at 950 m which proved in many respects to be one of the richest habitats.

The majority of the earwigs living in the vegetable mould are dull uniformly black or brown species.

Other orthopterous insects are a rare occurrence in the covering of the soil only representatives of the family *Gryllidae* sometimes making their appearance. Most of the species cannot be said to be truly surface-living but one, *Cycloptilum majus* CHOP. (fig. 6) is characteristic by dwelling between fallen leaves.

Thysanoptera.

By our former investigations we brought to light also some Thysanoptera and called attention to the fact of these delicate insects probably being not a

rare occurrence on the forest-floor but escaping notice owing to our special method of collecting. During our more recent research we have, however, never detected a specimen of these.

Isoptera.

This group of insects too does not belong to the true detritus-fauna, they often occur on the surface but only as occasional visitors, their real habitat being either deeper layers of the soil or wood.

Aptera.

These insects again play an important part as surface-dwellers although they were recorded only in 20 percent., this low figure being certainly due to our special method. *Thysanura* especially have been collected, but *Collembola* only in a very few instances. They were absent in two localities: Verlaten I. and in the grassy fields of Sumba. The most prolific locality concerning this particular group is again the mountain forest of the Idjen, the highest number both of species and individuals being recorded there. All these figures being very low are without doubt much below the real number to be found by a more specialised method of collecting.

Crustacea.

Among the crustaceans the *Oniscoida* or woodlice are very seldom missing as an element of the special fauna we are discussing here. Their presence was recorded in 73 percent., of none of the localities investigated their absence having to be mentioned, only at Depok they are poorly represented. The number of species found on 1 m^2 is never high, the maximum being 3 is recorded from the Idjen forest at an altitude of 1400 m. Formerly the highest number of specimens from the same area was observed in the mangrove-wood at Batavia, our more recent researches yielding a much higher number, nearly 500, which figure was provided by the mixed forest on Verlaten I. of the Krakatau group.

Species often collected are *Cubaris* spp., which are capable of rolling up into a ball; other common forms belong to the genera *Nagara* and *Alloniscus*.

Other groups of the Crustacea are very seldom represented, though terrestrial Amphipods belonging to the genus *Orchestia* are sometimes met with. In our previous paper we have recorded them only from near the seashore and again from an altitude between 1400 and 2400 m but now we have found them also at Kananggar on Sumba at an elevation of 700 m only.

Myriopoda.

Myriopods play an important part in the tropics as surface-dwelling animals. As a whole the group was absent in 30% of our findings, coming in this respect only a little behind the woodlice. The poorest locality investigated concerning millipedes is again Depok. On the other hand the forest on the Idjen in East Java showed again the highest number of species and individuals on one square

metre. Seven species from the said area, 3 Chilopods and 4 Diplopods, have been found in the forest at 1850 m, whereas the maximum number of specimens, 46 being all Diplopods, was recorded from forest at an elevation of 1400 m.

The two elements composing this group, the carnivorous Chilopoda and the Diplopoda with a vegetable diet, are represented in about the same percentages but Diplopods or millipedes are more numerous especially as far as the number of individuals is concerned, the maximum number being 46 as already mentioned above and for the Chilopods only 9. The latter figure has been recorded from the forest at Kananggar in Sumba at 700 m. Much higher numbers were found formerly on the coral-islands in the Batavia bay.

Chilopods, the centipedes, were never absent from any locality examined but Diplopods are occasionally missing, *e.g.* on the island of Bawean. In 1920 Diplopods were not represented on Verlaten Island but during our recent investigation they were present in not less than 70 percent. of our findings, a remarkable increase.

Among the Diplopods besides the more common Juloidea the Polydesmids are not infrequently collected but members of other groups are seldom or never seen.

Unfortunately we have not yet succeeded in getting our material worked out.

Arachnoidea.

The Arachnoids form the most ubiquitous group among the surface-living fauna their absence having been recorded in only 5%. In very few places only on Verlaten I. and at Depok did they prove to be absent. The highest figures, 15 species and 66 individuals on 1 m^2, are again yielded by the Idjen forest at 1400 m.

Of the Arachnoidea the *Araneina* or spiders are a very common feature being represented in every locality. We may find as high a number as 9 species on 1 m^2 and as many individuals as 39. The maximum number of species was discovered again in the forest of the Idjen mountains but the maximum number of specimens was found on Krakatau I. The latter number seems to be abnormally high as the average number of specimens on 1 m^2 is only 6.5, but during our previous researches an even higher number has been recorded from Zuid-Wachter, a small island in the Java Sea.

Most of the ground-dwelling spiders are dull sober-coloured species, sometimes shining brown and black like *Oedignatha scrobiculata* THOR. and *Ariadna snellemanni* HASS. Others again are hairy, like the members of the family *Lycosidae,* which are true hunting spiders, to which also belongs the somewhat brighter coloured *Trochosa inops* THOR., a common feature of the fauna of the forest-litter.

Less frequently met with than spiders are the *Acarina* or mites, being found in 53 percent. (formerly 62%), but our special method of investigation does certainly not do sufficient justice to this group, many of the more delicate or tiny species not making themselves apparent. That they are more abundant

and more omnipresent was proved by the mechanical method of sifting described in my previous article. Also in temperate zones mites are often the chief faunal element of the forest-floor covering.

The maximum number of species detected at the same time was 7 and the maximum number of individuals 51, both figures again we found in the Idjen forest at an altitude of 1400 m.

Among the commonest forms found in mould are the velvety red species of *Trombidium* and allied genera, and the brown coloured Gamasids both being carnivorous and often living, in the larval stage, a parasitic or semi-parasitic life. But there are a number of other species, *e.g.* belonging to the family *Oribatidae*, the diet of which is probably of a vegetable nature.

Of surface-living Arachnoids other than spiders and miles we have to mention specially the *Opiliones* or Harvest-spiders and the *Pseudoscorpiones* or False scorpions. Both carnivorous groups have been recorded from nearly every locality but never in great quantities or in a large number of species.

Besides the two last-mentioned orders, still other groups belonging to the Arachnoidea are a rare occurrence on the forest-floor. Occasionally a true scorpion or a Telyphonid or whip-scorpion is met with, otherwise creatures more often found under stones or logs.

Mollusca.

Molluscs are an essential element of the tropical detritus-fauna, formerly they were present in no less than 73 percent., but during our more recent researches only half the number of places examined revealed representatives of this group. This is mainly due to some localities now investigated proving somewhat deficient in this particular group of ainmals, *e.g.* Durian, Verlaten I., Depok and the grassy plains of Sumba. Also the maximum numbers of species and individuals formerly recorded were much higher, the first-named maximum now being 6 and the last-mentioned one 146; in the forest on the Idjen-massif at 1850 m these figures were observed again.

As to the different species we may refer to our previous paper where we have already enumerated some of the more common genera: *Kaliella, Opeas* (see fig. 7), *Prosopeas*.

Fig. 7. *Opeas gracile* (× 2½).

Oligochaeta.

As a matter of fact many groups of worms are found living in vegetable mould but only two could be collected by our method in any numbers, viz. the true earthworms and the smaller *Enchytraeids*. As already mentioned the earthworms, moreover, would for the greater part retire into deeper soil as soon as the covering of leaves and mould was gathered together. Therefore our figures have only a relative value.

Durian was the only locality yielding no worms at all. On Verlaten Island the absence of true earthworms is noteworthy, but our recent investigation revealed small Enchytraeids. When the previous search was made these were also absent. That rich locality, the Kendeng forest on the Idjen plateau, harboured again the highest number of individuals, 91 Enchytraeids on one square metre. Localities which show a deficiency in worms are the forest at Depok and the grassy plains of Sumba.

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APPENDIX A.

List of localities where the surface-fauna has been examined.

Loc. Nos 1 - 7. **Durian Island,** Riau Archipelago.
Soil: a yellow laterite quartzy soil.
Vegetation: mixed forest, partly secondary growth (Nos 1, 2 and 3).
Data: 13 - 17 VI 1923 (Nos 1, 2, 4 and 7) and 11 - 16 XI 1923 (Nos 3, 5 and 6).

Loc. Nos 8 - 17. **Krakatau,** S.E. coast, Sunda Straits.
Soil: recent volcanic ash and pumice.
Vegetation: mixed forest (Nos 8 - 13); Casuarina forest fringing the sea-shore (Nos 14 - 17).
Data: 10 XI 1932 (Nos 12 and 13); 7 I 1933 (Nos 14 and 15); 28 - 29 IV 1923 (Nos 8, 9, 16 and 17); 7 IV 1934 (Nos 10 and 11).

Loc. Nos 18 - 31. **Verlaten Island,** N. coast, Sunda Straits.
Soil: recent volcanic sand and pumice.
Vegetation: devastated forest (Nos 18 and 19); mixed forest (Nos 20, 22 - 26); Casuarina forest (Nos 21, 27 - 31).
Data: 22 - 24 VIII 1930 (Nos 18 - 21); 5 - 6 I 1933 (Nos 22, 23, 27 and 28); 30 IV 1933 (Nos 24 and 29); 9 - 12 XII 1933 (Nos 25, 26, 30 and 31).

Loc. 32 - 39. **Depok,** between Batavia and Buitenzorg, alt. 100 m.
Soil: quaternary tuff, a poor red laterite soil.
Vegetation: mixed forest inside the nature reserve (Nos 32 - 35); idem, outside the nature reserve (Nos 36 - 39).
Data: 2 II 1930 (Nos 32, 33, 36 and 37); 25 V 1930 (Nos 34, 35, 38 and 39).

Loc. Blawan, **Idjen** massif, E. Java, alt. 950 m.
Soil: recent dark volcanic ash.
Vegetation: mixed forest (Nos 40 and 41); rocky mass with very scanty vegetation, no mould (Nos 42 and 43).
Data: 1 VI 1924 (No 40); 4 VI 1924 (Nos 42 and 43); 7 VI 1924 (No 41).

Loc. Kendeng, **Idjen** massif, E. Java, alt. 1400 m.
Soil: recent dark volcanic ash.
Vegetation: mixed forest (Nos 44 and 45).
Data: 15 VI 1924 (Nos 44 and 45).

Loc. Telaga waroe, **Idjen** massif, E. Java, alt. 1700 m.
Soil: recent dark volcanic ash.
Vegetation: a very thin layer of moss (No 46).
Datum: 25 V 1924 (No 46).

Loc. Ongop-ongop, **Idjen** massif, E. Java, alt. 1850 m.
Soil: recent dark volcanic ash.
Vegetation: mixed forest (Nos 47 and 48); Casuarina forest (Nos 49 and 50); grassy plain and ferns, mould very scarce (Nos 51 and 52).
Data: 18 V 1924 (Nos 49 and 50); 20 - 21 V 1924 (Nos 47, 48, 51 and 52).

Loc. **Karimon Java** Island, Java Sea.
Soil: old laterite.
Vegetation: mixed forest (Nos 53 - 56).
Data: 11 - 12 V 1926 (Nos 53 - 56).
Loc. **Bawean** Island, Java Sea, south coast.
Soil: old laterite.
Vegetation: mixed forest, secondary growth, many shrubs, mould very scarce (Nos 57 - 60).
Data: 7 - 9 V 1928 (Nos 57 - 60).
Loc. Kambera, N.E. **Sumba.**
Soil: a calcareous soil.
Vegetation: mixed forest (Nos 61 - 63); grass, mould very scarce (Nos 64 and 65).
Data: 20 III 1925 (Nos 61 and 62); 29 III 1925 (Nos 63 - 65).
Loc. Laora, West **Sumba,** alt. 100 m.
Soil: probably marly or calcareous.
Vegetation: mixed forest (Nos 66 and 67); grass, scarcely any mould (Nos 68 and 69).
Data: 9 IV 1925 (Nos 66 and 67); 14 IV 1925 (Nos 68 and 69).
Loc. Mao Marroe, East **Sumba,** alt. 450 m.
Soil: unknown.
Vegetation: mixed forest (Nos 70 and 71); grass, scarcely any mould (Nos 72 and 73).
Data: 6 - 8 V 1925 (Nos 70 - 73).
Loc. Kananggar, East **Sumba,** alt. 700 - 850 m.
Soil: a dark sandy quartzy soil.
Vegetation: mixed forest (Nos 74 - 76); grass, no mould (Nos 77 and 78).
Data: 18 V 1925 (Nos 75 and 76); 20 V 1925 (74, 77 and 78).

APPENDIX B.

Survey of the number of species and individuals found on 1 m².

	number of species on 1 m²			number of indiv. on 1 m²		
	aver.	max.	min.	aver.	max.	min.
Durian (Riau archipelago)	19.3	35	10	23.4	57	9
Lake Toba (N. Sumatra), 900 - 1200 m	25	34	17	34	45	23
Pedada Bay (Lampongs, S. Sumatra)	41	41	41	147	171	124
Sebesy I. (Sunda Straits)	16.3	26	7	45.2	94	11
„ „ virgin forest	15.3	24	7	42.5	80	11
„ „ Casuarina forest	18 3	26	11	55.7	94	19
Krakatau (Sunda Straits), 1919-1920	18	27	8	58.7	118	27
„ virgin forest	20.4	27	13	68.4	118	29
„ Casuarina forest	14	23	8	38	55	27
Krakatau, 1932 - 1934	18.7	26	12	55 9	145	23
„ virgin forest	19 5	26	12	44	70	32
„ Casuarina forest	17.5	23	13	73.5	145	23
Verlaten I. (Sunda Straits), 1919 - 1920	12.4	24	7	149	274	29
„ „ virgin forest	17	24	10	156	206	43
„ „ Casuarina forest	7.8	8	7	139	274	29
Verlaten I., 1930 - 1933	13.8	20	10	125	509	14
„ „ virgin forest	14.2	17	13	183	509	88
„ „ Casuarina forest	13.5	20	10	67	211	14
Prinsen I. (Sunda Straits)	31	46	23	124	248	50
N. Wachter (Java Sea)	30.5	32	29	—	—	—
Z. Wachter (Java Sea)	19.5	20	19	—	—	—
Klein Kombuis (Java Sea)	29 4	37	21	192	265	108
Batavia Bay — islands	13.9	23	7	—	—	—
Batavia, mangrove	28.3	37	22	—	—	—
Depok (W. Java), 100 m, 1922 - 1923	27	73	11	42	189	8
„ inside nature-reserve	29.3	73	12	50 8	189	10
„ outside nature-reserve	23 5	39	11	28 8	52	8
Depok, 1930	13.4	21	5	13.6	23	6
„ inside nature-reserve	13 8	21	5	13.8	18	9
„ outside nature-reserve	13	17	8	13.5	23	6
Buitenzorg, second. forest, 250 m	19	25	13	30	42	10
„ (Botanical Garden)	20.9	39	10	45	118	10
Tjampea (n. Buitenzorg), 300 m	34.5	35	34	82.5	96	69
Poentjak (W. Java), 1500 m	48	—	—	138	—	—
Tjibodas (W. Java), forest, 1400 m	60 9	88	41	237	505	117
Mt. Gede (W. Java), 2000 - 2400 m	34	47	27	495	1167	97
Mt. Pangerango (W. Java), 3000 m	11.3	16	6	43 5	69	20
Mt. Malabar (W. Java), 1600 m	41.5	46	37	130	150	109
Idjen (E. Java)	30.4	66	4	124	258	6
„ forest, 950 - 1400 m	48.8	66	22	183	258	55
„ „ 1850 m.	36.5	39	33	191	226	166
Karimon Java (Java Sea)	17.3	22	13	29	46	14
Bawean I. (Java Sea)	16	24	10	20	30	10
Sumba	21.5	40	5	42 2	149	4
„ forest	25.6	40	10	60,6	149	19
„ grass	16.4	25	5	19 3	32	4
Total	24	88	4	90	1167	4

APPENDIX C.

	Riau														Krakatau
No.	1		2		3		4		5		6		7		8
Locality and kind of vegetation.	Durian Forest		Durian Forest		Durian Forest		Durian Forest		Forest Durian		Durian Forest		Durian Forest		Krakatau
Altitude	0 m		0 m		0 m		50 m		50 m		70 m		175 m		0 m
Month	June		June		Nov.		June		Nov.		Nov.		June		Apr
Layer of leaves and mould (in cm)	5 cm		4 cm		2 cm		4.5 cm		3 cm		3 cm		3.5 cm		2.5 c
Number and species on 1 m²	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.
Hymenoptera	—	3	—	4	—	5	—	7	—	4	—	2	—	2	—
Formicidae	—	3	—	4	—	5	—	7	—	4	—	2	—	2	—
Coleoptera	—	—	28	10	—	—	2	2	4	3	6	4	1	1	7
Carabidae	—	—	3	2	—	—	1	1	—	—	—	—	—	—	—
Staphylinidae	—	—	23	6	—	—	—	—	4	3	—	—	—	—	3
Pselaphidae	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1
Tenebrionidae	—	—	—	—	—	—	—	—	—	—	1	1	—	—	2
Curculionidae	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—
Diptera (larvae)	—	—	2	2	—	—	—	—	—	—	1	1	—	—	—
Lepidoptera (larvae)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8
Rhynchota	—	—	—	—	1	1	—	—	1	1	—	—	—	—	4
Heteroptera	—	—	—	—	1	1	—	—	1	1	—	—	—	—	4
Orthoptera	2	2	5	3	1	1	—	—	7	3	4	3	4	2	7
Blattidae	1	1	1	1	1	1	—	—	4	2	3	2	—	—	7
Forficulidae	—	—	4	2	—	—	—	—	3	1	—	—	4	2	—
Isoptera	—	—	—	1	—	1	—	—	—	1	—	—	—	1	—
Aptera	—	—	1	1	—	—	—	—	—	—	—	—	2	2	—
Crustacea	3	1	6	2	—	—	2	1	5	2	2	1	1	1	—
Oniscoidea	3	1	6	2	—	—	2	1	5	2	2	1	1	1	—
Amphipoda	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Myriopoda	1	1	1	1	1	1	—	—	1	1	1	1	1	1	1
Chilopoda	—	—	—	—	1	1	—	—	—	—	—	—	1	1	—
Diplopoda	1	1	1	1	—	—	—	—	1	1	1	1	—	—	1
Arachnoidea	3	3	11	9	5	5	9	8	16	9	8	6	9	5	5
Araneina	2	2	6	4	3	3	5	5	11	7	1	1	3	2	1
Acarina	1	1	3	3	2	2	—	—	—	—	3	3	5	2	4
Mollusca	—	—	3	2	3	1	—	—	—	—	—	—	—	—	—
Oligochaeta	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	9	10	57	35	11	15	13	18	34	24	22	18	18	15	32

	Krakatau																		Verlaten I.							
No.	9		10		11		12		13		14		15		16		17		18		19		20		21	
Locality and kind of vegetation.	Krakatau Forest		Krakatau Forest		Krakatau Forest		Krakatau Forest		Krakatau Forest		Krakatau Casuarina		Krakatau Casuarina		Krakatau Casuarina		Krakatau Casuarina		Verlaten I. Dev. Forest		Verlaten I. Dev. Forest		Verlaten I. Forest		Verlaten I. Casuarina	
Altitude	0 m		0 m		0 m		0 m		0 m		0 m		0 m		0 m		0 m		0 m		0 m		0 m		0 m	
Month	April		April		April		Nov.		Nov.		Jan.		Jan.		April		April		Aug.		Aug.		Aug.		Aug.	
Layer of leaves and mould (in cm)	3.5 cm		3 cm		3 cm		4 cm		3.5 cm		2.5 cm		2 cm		3 cm		3 cm		3.5 cm		3 cm		4 cm		5 cm	
Number and species on 1 m²	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.
Hymenoptera	—	7	—	4	—	5	—	4	—	2	—	—	—	2	—	6	—	4	—	3	—	4	—	4	—	3
Formicidae	—	7	—	4	—	5	—	4	—	2	—	—	—	2	—	6	—	4	—	3	—	4	—	4	—	3
Coleoptera	10	7	—	—	1	1	1	1	—	—	3	1	3	3	—	—	1	1	1	1	2	2	4	2	10	6
Carabidae	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	1	1
Staphylinidae	2	2	—	—	1	1	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	3	2
Pselaphidae	2	2	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—
Tenebrionidae	4	2	—	—	—	—	1	1	—	—	3	1	—	—	—	—	—	—	—	—	—	—	1	1	4	1
Curculionidae	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Diptera (larvae)	—	—	1	1	—	—	—	—	—	—	1	1	—	—	—	—	7	1	—	—	—	—	—	—	—	—
Lepidoptera (larvae)	1	1	1	1	3	2	—	—	—	—	—	—	4	1	8	1	8	1	—	—	—	—	—	—	—	—
Rhynchota	—	—	—	—	—	—	2	2	—	—	1	1	3	2	14	4	3	2	—	—	1	1	4	3	3	2
Heteroptera	—	—	—	—	—	—	1	1	—	—	1	1	3	2	14	4	3	2	—	—	1	1	4	3	3	2
Orthoptera	—	—	16	3	23	4	4	3	12	3	—	—	—	—	2	2	1	1	1	1	2	2	5	1	10	2
Blattidae	—	—	13	2	15	3	1	1	7	2	—	—	—	—	2	2	1	1	1	1	2	2	5	1	8	1
Forficulidae	—	—	3	1	8	1	2	1	5	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1
Isoptera	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Aptera	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2	1	—	—	—	—	—	—	—	—	—	—
Crustacea	3	1	26	1	6	1	1	1	7	1	1	1	5	1	68	1	—	—	10	1	14	1	111	1	181	1
Oniscoidea	3	1	26	1	6	1	1	1	7	1	1	1	5	1	68	1	—	—	10	1	14	1	111	1	181	1
Amphipoda	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Myriopoda	2	1	9	3	3	2	11	2	2	1	7	2	5	2	8	1	8	1	—	—	—	—	—	—	4	3
Chilopoda	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
Diplopoda	2	1	8	2	3	2	11	2	2	1	7	2	5	2	8	1	8	1	—	—	—	—	—	—	2	1
Arachnoidea	16	7	15	5	11	3	14	6	15	4	5	4	6	1	42	6	6	4	—	—	6	4	2	2	2	2
Araneina	4	3	13	4	11	3	13	5	14	3	3	2	6	1	39	4	5	3	—	—	5	3	2	2	1	1
Acarina	9	3	2	1	—	—	1	1	1	1	—	—	—	—	2	1	1	1	—	—	—	—	—	—	1	1
Mollusca	3	1	1	1	—	—	—	—	—	—	4	2	51	3	—	—	8	1	—	—	—	—	4	1	1	1
Oligochaeta	6	1	1	1	1	1	4	1	1	1	1	1	4	1	1	1	2	1	—	—	—	—	—	—	—	—
Total	41	26	70	20	48	19	37	20	37	12	23	13	82	17	145	23	44	17	12	7	25	14	130	14	211	20

	Verlaten I.															
No.	22		23		24		25		26		27		28		29	
Locality and kind of vegetation.	Verlaten I. Forest		Verlaten I. Forest		Verlaten I. Forest		Verlaten I. Forest		Verlaten I. Forest		Verlaten I. Casuarina		Verlaten I. Casuarina		Verlaten I. Casuarina	
Altitude	0 m		0 m		0 m		0 m		0 m		0 m		0 m		0 m	
Month	Jan.		Jan.		April		Dec.		Dec.		Jan.		Jan.		April	
Layer of leaves and mould (in cm)	2.5 cm		2.5 cm		2 cm		2 cm		2 cm		3 cm		3 cm		3 cm	
Number and species on 1 m^2	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.
Hymenoptera	—	3	—	3	—	4	—	4	—	3	—	2	—	4	—	
Formicidae	—	3	—	3	-	4	—	4	—	3	—	2	—	4	—	
Coleoptera	4	3	7	2	1	1	6	5	3	3	2	2	1	1	3	
Carabidae	—	—	—	—	—	—	3	2	1	1	1	1	—	—	1	
Staphylinidae	—	—	—	—	1	1	1	1	1	1	—	—	1	1	2	
Pselaphidae	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	
Tenebrionidae	3	2	7	2	—	—	1	1	1	1	1	1	—	—	—	
Curculionidae	—	—	—	—	—	—	—	—	-	—	—	—	—	—	—	
Diptera (larvae)	1	1	—	—	—	—	—	—	—	—	—	—	-	—	1	
Lepidoptera (larvae)	—	—	—	—	—	—	4	2	—	—	5	1	2	1	—	
Rhynchota	3	1	2	1	1	1	7	2	1	1	—	—	—	—	6	
Heteroptera	3	1	2	1	1	1	7	2	1	1	—	—	—		6	
Orthoptera	8	1	—	—	2	1	2	2	1	1	—	—	—	—	—	
Blattidae	8	1	—	—	2	1	2	2	1	1	—		—	—	—	
Forficulidae	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Isoptera	—	—	—	—	—		—	—	—	—	—	—	—	1	—	
Aptera	—	—	—	—	—	—	—	—	—		—	—	—	—	—	
Crustacea	113	1	111	1	496	1	66	1	91	1	12	1	4	1	50	
Oniscoidea	113	1	111	1	496	1	66	1	91	1	12	1	4	1	50	
Amphipoda	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Myriopoda	2	1	2	1	1	1	—	—	4	1	3	1	2	1	1	
Chilopoda	—	—	—	—	1	1	—	—	4	1	—	-	—	—	—	
Diplopoda	2	1	2	1	—	—	—	—	—	—	3	1	2	1	1	
Arachnoidea	2	1	7	4	8	6	3	1	3	2	6	4	5	4	4	
Araneina	2	1	7	4	5	4	3	1	3	2	5	3	3	3	1	
Acarina	—	—	—	—	3	2	—	—	—	—	—	—	—	—	1	
Mollusca	1	1	—	—	—	—	—	—	—	—	1	1	—	—	—	
Oligochaeta	—	—	4	1	—	—	—	—	1	1	—	—	—	—	—	
Total	134	13	133	13	509	15	88	17	104	13	29	12	14	13	65	1

					Depok, W. Java															
No.	30		31		32		33		34		35		36		37		38		39	
Locality and kind of vegetation.	Verlaten I. Casuarina		Verlaten I. Casuarina		Depok Forest Nr.		Depok Forest Nr.		Depok Forest Nr.		Depok Forest Nr.		Depok Forest		Depok Forest		Depok Forest		Depok Forest	
Altitude	0 m		0 m		100 m		100 m		100 m		100 m		100 m		100 m		100 m		100 m	
Month	Dec.		Dec.		Febr.		Febr.		May		May		Febr.		Febr.		May		May	
Layer of leaves and mould (in cm)	2.5 cm		3 cm		3 cm		3.5 cm		4 5 cm		3 cm		4 cm		2 cm		2.5 cm		2.5 cm	
Number and species on 1 m^2	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.
Hymenoptera	—	4	—	4	—	5	—	5	—	5	—	2	—	5	—	4	—	3	—	4
Formicidae	—	4	—	3	—	5	—	5	—	5	—	2	—	5	—	4	—	3	—	4
Coleoptera	2	2	—	—	8	6	8	7	8	4	5	2	17	8	8	6	2	1	6	5
Carabidae	—	—	—	—	3	2	—	—	1	1	1	1	—	—	—	—	—	—	1	1
Staphylinidae	—	—	—	—	3	2	3	3	3	1	—	—	3	2	2	1	2	1	1	1
Pselaphidae	1	1	—	—	1	1	1	1	—	—	—	—	7	4	2	2	—	—	3	2
Tenebrionidae	1	1	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—
Curculionidae	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Diptera (larvae)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lepidoptera (larvae)	10	1	15	1	1	1	—	—	1	1	—	—	—	—	2	2	—	—	—	—
Rhynchota	2	2	1	1	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—
Heteroptera	2	2	1	1	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—
Orthoptera	1	1	2	1	—	—	2	2	1	1	—	—	1	1	—	—	—	—	—	—
Blattidae	1	1	2	1	—	—	2	2	1	1	—	—	1	1	—	—	—	—	—	—
Forficulidae	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Isoptera	—	—	—	1	—	--	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aptera	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	1	1	—	—
Crustacea	21	1	9	1	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oniscoidea	21	1	9	1	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Amphipoda	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Myriopoda	7	1	13	1	—	—	2	2	—	—	—	—	1	1	—	—	—	—	—	—
Chilopoda	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—
Diplopoda	7	1	13	1	—	—	1	1	—	—	—	—	1	1	—	—	—	—	—	—
Arachnoidea	—	—	—	—	4	2	5	4	--	—	4	1	4	2	6	3	3	3	1	1
Araneina	—	—	—	—	2	1	4	3	—	—	—	—	2	1	6	3	2	2	1	1
Acarina	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—
Mollusca	—	—	—	—	1	1	—	—	1	1	—	—	—	—	1	1	—	—	—	—
Oligochaeta	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—
Total	43	12	40	10	16	16	18	21	12	13	9	5	23	17	18	17	6	8	7	10

	Idjen, E. Java																	
No.	40		41		42		43		44		45		46		47		48	
Locality and kind of vegetation.	Blawan Forest		Blawan Forest		Blawan Rocky mass		Blawan Rocky mass		Kendeng Forest		Kendeng Forest		Telaga Waroe Moss		Ongop-ongop Forest		Ongop-ongop Forest	
Altitude	950 m		950 m		950 m		950 m		1400 m		1400 m		1700 m		1850 m		1850 m	
Month	June		June		June		June		June		June		May		May		May	
Layer of leaves and mould (in cm)	4.5 cm		2.5 cm		0 cm		0 cm		3 cm		3 cm		0 cm		4.5 cm		4 cm	
Number and species on 1 m²	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.
Hymenoptera	—	5	—	2	3	2	8	4	—	1	—	2	2	1	—		—	—
Formicidae	—	5	—	2	3	2	8	4	—	1	—	2	2	1	—		—	—
Coleoptera	31	17	7	6	5	3	33	6	61	29	26	14	1	1	59		24	12
Carabidae	1	1	—	—	—	—	1	1	4	4	6	4	—	—	—		—	—
Staphylinidae	10	5	7	6	—	—	1	1	40	14	12	5	1	1	56		11	7
Pselaphidae	4	2	—	—	—	—	—	—	3	3	2	1	—	—	1		5	1
Tenebrionidae	—	—	—	—	3	1	1	1	—	—	—	—	—	—	—		—	—
Curculionidae	3	2	—	—	1	1	27	1	—	—	—	—	—	—	—		—	—
Diptera (larvae)	1	1	1	1	—	—	—	—	4	3	—	—	—	—	5		4	2
Lepidoptera (larvae)	5	1	—	—	—	—	—	—	4	2	2	1	—	—	—		1	1
Rhynchota	61	7	—	—	—	—	3	1	8	2	8	5	—	—	2		—	—
Heteroptera	61	7	—	—	—	—	3	1	8	2	8	5	—	—	2		—	—
Orthoptera	54	5	14	6	—	—	—	—	7	3	1	1	—	—	9		2	1
Blattidae	15	2	3	3	—	—	—	—	4	1	1	1	—	—	8		2	1
Forficulidae	39	3	10	2	—	—	—	—	2	1	—	—	—	—	1		—	—
Isoptera	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—
Aptera	3	2	1	1	—	—	—	—	—	—	1	1	—	—	1		4	2
Crustacea	5	1	27	1	—	—	—	—	26	4	16	2	—	—	2		17	2
Oniscoidea	5	1	27	1	—	—	—	—	25	3	16	2	—	—	2		17	2
Amphipoda	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—		—	—
Myriopoda	6	3	1	1	—	—	—	—	46	3	23	4	—	—	19		8	5
Chilopoda	2	2	1	1	—	—	—	—	—	—	2	2	—	—	6		5	3
Diplopoda	4	1	—	—	—	—	—	—	46	3	21	2	—	—	13		3	2
Arachnoidea	37	14	4	4	1	1	4	2	66	15	29	13	3	2	8		11	6
Araneina	18	9	1	1	1	1	—	—	11	6	11	8	3	2	7		2	2
Acarina	18	4	3	3	—	—	4	2	51	7	11	3	—	—	1		8	3
Mollusca	10	3	—	—	—	—	—	—	15	3	9	3	—	—	51		146	6
Oligochaeta	—	—	—	—	—	—	—	—	21	1	91	1	—	—	10		9	2
Total	213	60	55	22	9	6	48	13	258	66	206	47	6	4	166		226	39

									Karimon Java								Bawean							
No.	49		50		51		52		53		54		55		56		57		58		59		60	
Locality and kind of vegetation.	Ongop-ongop Casuarina		Ongop-ongop Casuarina		Ongop-ongop Grass		Ongop-ongop Grass		Karimon J. Forest		Karimon J. Forest		Karimon J. Forest		Karimon J. Forest		Bawean Forest		Bawean Forest		Bawean Forest		Bawean Forest	
Altitude	1850 m		1850 m		1850 m		1850 m		0 m		0 m		250 m		250 m		0 m		0 m		100 m		100 m	
Month	May		May		May		May		May		May		May		May		May		May		May		May	
Layer of leaves and mould (in cm)	2.5 cm		3.5 cm		0 cm		0 cm		1.5 cm		1.5 cm		2 cm		2 cm		1 5 cm		1 cm		1.5 cm		1.5 cm	
Number and species on 1 m²	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.
Hymenoptera	—	—	—	—	—	—	2	1	—	—	—	3	—	2	—	3	—	6	—	1	—	2	—	2
Formicidae	—	—	—	—	—	—	2	1	—	—	—	3	—	2	—	3	—	6	—	1	—	2	—	2
Coleoptera	32	11	33	15	8	5	13	8	1	1	1	1	2	2	—	—	3	3	—	—	—	—	5	4
Carabidae	3	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—
Staphylinidae	18	5	22	9	2	2	4	4	1	1	—	—	1	1	—	—	—	—	—	—	—	—	4	3
Pselaphidae	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tenebrionidae	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—
Curculionidae	9	1	3	1	2	1	4	1	—	—	—	—	1	1	—	—	—	—	—	—	—	—	1	1
Diptera (larvae)	—	—	1	1	1	1	12	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lepidoptera (larvae)	3	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchota	16	4	14	3	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Heteroptera	16	4	14	3	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Orthoptera	18	4	36	3	—	—	2	1	5	2	—	—	13	3	16	5	3	1	2	2	1	1	5	2
Blattidae	10	1	26	1	—	—	—	—	5	2	—	—	13	3	16	5	—	—	1	1	1	1	2	1
Forficulidae	7	2	10	2	—	—	2	1	—	—	—	—	—	—	—	—	3	1	1	1	—	—	3	1
Isoptera	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aptera	—	—	—	—	1	1	—	—	1	1	—	—	—	—	—	—	—	—	1	1	—	—	—	—
Crustacea	45	2	24	2	—	—	—	—	3	1	3	1	5	1	3	1	2	1	3	1	3	2	7	1
Oniscoidea	45	2	24	2	—	—	—	—	3	1	3	1	5	1	3	1	2	1	3	1	3	2	7	1
Amphipoda	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Myriopoda	1	1	10	3	—		5	2	2	2	1	1	2	2	1	1	3	2	—	—	2	2	1	1
Chilopoda	1	1	1	1	—	—	1	1	2	2	1	1	1	1	1	1	3	2	—	—	2	2	1	1
Diplopoda	—	—	9	2	—	—	4	1	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—
Arachnoidea	32	9	21	5	1	1	5	4	8	8	6	4	24	12	13	7	14	9	5	5	3	3	7	5
Araneina	7	4	9	4	1	1	4	3	6	6	3	2	19	9	10	5	4	4	4	4	2	2	5	3
Acarina	17	4	—	—	—	—	1	1	1	1	—	—	1	1	1	1	2	1	—	—	-	—	1	1
Mollusca	24	4	60	5	2	1	4	2	2	1	1	1	—	—	1	1	4	2	—	—	1	1	2	2
Oligochaeta	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—	—	—	2	1
Total	171	37	199	37	13	9	44	22	22	16	14	13	46	22	34	18	29	24	11	10	10	11	30	19

	Sumba															
No.	61		62		63		64		65		66		67		68	
Locality and kind of vegetation.	Kambera Forest		Kambera Forest		Kambera Forest		Kambera Grass		Kambera Grass		Laora Forest		Laora Forest		Laora Grass	
Altitude	0 m		0 m		0 m		0 m		0 m		100 m		100 m		100 m	
Month	March		March		March		March		March		April		April		April	
Layer of leaves and mould (in cm)	6 cm		2.5 cm		4 cm		0 cm		0 cm		2 cm		4 cm		0 cm	
Number and species on 1 m²	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.
Hymenoptera	—	4	—	1	—	4	—	—	—	3	—	6	—	6	—	6
Formicidae	—	4	—	1	—	4	—	—	—	3	—	6	—	6	—	6
Coleoptera	16	7	1	1	4	2	7	5	1	1	7	6	2	2	10	9
Carabidae	—	—	1	1	—	—	1	1	—	—	2	2	1	1	3	2
Staphylinidae	8	5	—	—	2	1	4	3	—	—	4	3	1	1	2	2
Pselaphidae	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tenebrionidae	7	1	—	—	—	—	—	—	—	—	—	—	—	—	2	2
Curculionidae	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Diptera (larvae)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lepidoptera (larvae)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchota	2	1	1	1	—	—	3	2	—	—	10	3	—	—	1	1
Heteroptera	2	1	1	1	—	—	3	2	—	—	10	3	—	—	1	1
Orthoptera	6	2	12	3	—	—	—	—	—	—	2	1	1	1	3	2
Blattidae	1	1	1	1	—	—	—	—	—	—	—	—	1	1	1	1
Forficulidae	5	1	11	2	—	—	—	—	—	—	2	1	—	—	2	1
Isoptera	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aptera	3	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Crustacea	10	2	—	—	—	—	4	2	—	—	101	2	21	2	—	—
Oniscoidea	10	2	—	—	—	—	4	2	—	—	101	2	21	2	—	—
Amphipoda	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Myriopoda	5	3	—	—	4	2	10	1	—	—	1	1	1	1	1	1
Chilopoda	4	2	—	—	3	1	—	—	—	—	1	1	1	1	1	1
Diplopoda	1	1	—	—	1	1	10	1	—	—	—	—	—	—	—	—
Arachnoidea	26	9	5	4	10	6	7	6	5	4	14	9	11	6	6	5
Araneina	22	7	5	4	8	4	6	5	3	2	14	9	11	6	3	3
Acarina	—	—	—	—	—	—	1	1	2	2	—	—	—	—	2	1
Mollusca	3	2	—	—	—	—	1	1	—	—	3	2	3	1	—	—
Oligochaeta	19	2	—	—	6	2	—	—	—	—	11	2	—	—	—	—
Total	90	33	19	10	24	16	32	17	6	8	149	32	39	19	21	[illegible]

	Sumba																			
No.	69		70		71		72		73		74		75		76		77		78	
Locality and kind of vegetation.	Laora Grass		Mao Marroe Forest		Mao Marroe Forest		Mao Marroe Grass		Mao Marroe Grass		Kananggar Forest		Kananggar Forest		Kananggar Forest		Kananggar Grass		Kananggar Grass	
Altitude	100 m		450 m		450 m		450 m		450 m		700 m		850 m		850 m		700 m		700 m	
Month	April		May		May		May		May		May		May		May		May		May	
Layer of leaves and mould (in cm)	0 cm		3 cm		4 cm		0 cm		0 cm		2 cm		3 cm		3.5 cm		0 cm		0 cm	
Number and species on 1 m²	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.	n.	s.
Hymenoptera	—	5	—	6	—	7	—	4	—	6	—	7	—	3	—	—	—	3	—	1
Formicidae	—	5	—	6	—	7	—	4	—	6	—	7	—	3	—	—	—	3	—	1
Coleoptera	8	7	3	3	10	7	2	2	3	2	12	11	14	3	6	5	22	6	1	1
Carabidae	1	1	—	—	1	1	1	1	—	—	2	2	—	—	—	—	5	2	—	—
Staphylinidae	1	1	—	—	7	5	—	—	—	—	5	5	—	—	3	3	16	3	1	1
Pselaphidae	—	—	—	—	—	—	—	—	1	1	1	1	—	—	3	2	—	—	—	—
Tenebrionidae	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Curculionidae	—	—	1	1	—	—	—	—	—	—	—	—	1	1	—		—	—	—	—
Diptera (larvae)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lepidoptera (larvae)	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—
Rhynchota	1	1	3	2	5	4	3	2	2	2	4	3	3	2	2	1	1	1	—	—
Heteroptera	1	1	3	2	5	4	3	2	2	2	4	3	3	2	2	1	1	1	—	—
Orthoptera	8	2	1	1	2	2	1	1	2	2	3	3	4	2	4	2	4	3	—	—
Blattidae	—	—	—	—	1	1	—	—	1	1	1	1	3	1	3	1	2	1	—	—
Forficulidae	8	2	1	1	1	1	—	—	1	1	2	2	1	1	1	1	2	2	—	—
Isoptera	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aptera	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—
Crustacea	1	1	11	2	6	2	1	1	1	1	14	2	24	2	3	1	—	—	—	—
Oniscoidea	1	1	11	2	6	2	1	1	1	1	13	1	24	2	3	1	—	—	—	—
Amphipoda	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—
Myriopoda	2	2	—	—	1	1	—	—	—	—	9	3	2	1	1	1	—	—	—	—
Chilopoda	2	2	—	—	1	1	—	—	—	—	9	3	2	1	—	—	—	—	—	—
Diplopoda	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—
Arachnoidea	5	5	29	10	25	9	6	4	12	8	22	10	17	9	26	7	5	4	3	3
Araneina	5	5	18	8	19	8	3	2	8	5	19	7	14	7	20	5	3	3	2	2
Acarina	—	—	—	—	6	1	3	2	4	3	1	1	3	2	5	1	2	1	1	1
Mollusca	—	—	10	6	1	1	—	—	—	—	—	—	4	2	2	1	—	—	—	—
Oligochaeta	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	26	25	57	30	50	33	13	14	20	21	65	40	68	24	45	19	32	17	4	5

ZUR KENNTNIS DER VERBREITUNG UND DER LEBENSWEISE JAVANISCHER SÄUGETIERE.

Von

M. BARTELS Jr.

(Soekaboemi, Java).

BEHANDELTE ARTEN:

1. *Tupaia glis hypochrysa* THOS.
2. *Hylomys suillus suillus* S. MÜLL.
3. *Crocidura brunnea* JENT.
4. *Crocidura bartelsi* JENT.
5. *Chironax melanocephalus* (TEMM.).
6. *Coelops frithi* BLYTH.
7. *Nannosciurus melanotis melanotis* (MÜLL. & SCHLEG.).
8. *Petaurista petaurista petaurista* (PALL.).
9. *Petaurista elegans* (TEMM.).
10. *Hylopetes sagitta sagitta* (L.).
11. *Petinomys genibarbis genibarbis* (HORSF.).
12. *Rattus sabanus mayapahit* ROB. & KLOSS.
13. *Rattus surifer solaris* SODY.
14. *Pithecheirus melanurus melanurus* S. MÜLL.
15. *Arctogalidia trivirgata* subsp.
16. *Arctictis binturong albifrons* (CUV.).
17. *Prionodon linsang gracilis* (HORSF.).
18. *Mustela lutreolina* ROB. & THOS.
19. *Lutra* spec.
20. *Pithecus aygula fredericae* SODY.

1. Tupaia glis hypochrysa THOS.

Vorkommen. Diese Art galt bisher als „sehr selten". Tatsächlich wurden bis jetzt erst einige wenige Exemplare in der Literatur bekannt. Mein Vater sammelte vor vielen Jahren 2 Stück bei Pasir Datar, am Südwest-Abhang des Pangrango-Gede (etwa 1000 m ü.M.). Ich selbst erbeutete ein Stück an derselben Örtlichkeit und ein weiteres Exemplar in der Nähe der oberhalb Bandoeng in W.-Java gelegenen Plantage „Tjiboeni" (Höhe etwa 1500 m). Ziemlich häufig traf ich die Art dagegen in etwa Meereshöhe an der Wijnkoopsbai (W.-Java und ferner begegnete ich ihr an verschiedenen Stellen in der an der

Südküste W.-Javas gelegenen Landschaft Tjidamar. Die Art scheint demnach hauptsächlich das Tiefland zu bewohnen. Wir beobachteten die Tiere bisher nur im Walde.

Benehmen in der Freiheit. Im Gegensatz zu *T. javanica* hält sich diese Art vorwiegend auf dem Boden auf. Die Tiere bewegen sich hier, ihrer Nahrung nachgehend, mit hüpfenden Sprüngen vorwärts. Nur wenige Male sah ich sie die niederen Zweige von Sträuchern für kurze Zeit erklettern. Nicht selten traf ich sie paarweise an.

Stimme. Bisher hörte ich nur aufgescheuchte Exemplare einen Laut ausstossen. Sie gaben dann einen „bauchrednerischen" knurrend-fauchenden Ton zum besten, der oft mehrmals wiederholt wurde.

2. **Hylomys suillus suillus** S. Müll.

Vorkommen. Auch dieses Tier ist nach unseren Erfahrungen gar nicht so selten wie man früher vermutet hat. Es führt aber eine sehr versteckte Lebensweise und entzieht sich dadurch der Beobachtung. Mein Vater erhielt mehrere Exemplare aus den Urwäldern bei Pasir Datar am Südwest-Abhang des Pangrango. Ich selbst sammelte in den letzten Jahren Exemplare an folgenden Orten: Südwest-Abhang des Pangrango, ca. 1000 - 1300 m ü.M. (häufig), Tjiboeni oberhalb von Bandoeng, ca. 1400 - 1500 m ü.M. (häufig), West-Abhang des G. Slamet (M.-Java), ca. 2000 - 2500 m ü.M. (einige Ex.), und G. Lawoe auf der Grenze von M.- und O.-Java, ca. 1500 - 2000 m ü.M. (häufig).

Hylomys ist ein Bewohner feuchter Gebirgswälder mit dichtem Unterwuchs. Die Höhenverbreitung ist dabei merkwürdigerweise auf den einzelnen Vulkanen sehr verschieden. Die oben für den Pangrango, Slamet und Lawoe angeführten oberen Sammelgrenzen sind nämlich zugleich auch als die ungefähren Höchstgrenzen des Vorkommens auf diesen Vulkanen aufzufassen. Auf dem Slamet steigt die Art also bis in eine Höhe von 2500 m hinauf, während sie am Pangrango nur 1300, höchstenfalls vielleicht 1500 m erreicht. Eine „Erklärung" hierfür lässt sich vorderhand nicht geben. — Einige Male habe ich die Tiere auch etwas ausserhalb des Waldes im Kulturgelände (Kina- und Teepflanzungen) angetroffen, aber nur an Stellen wo ihnen geeignete Schlupfwinkel in Form von Baumstrünken u.dgl. zur Verfügung standen.

Benehmen in der Freiheit. Nach Müller wurde das von ihm gesammelte Exemplar geschossen, als es im Gezweige eines Kaffee-Strauches umherkletterte. Diese Beobachtung haben wir niemals bestätigen können, wir trafen die Tiere bisher immer n u r a u f d e m B o d e n an. Sie bewegen sich hier mit kurzen hüpfenden Sprüngen und laufend und wenn es sein muss (beim Flüchten) mit grosser Schnelligkeit vorwärts. Dabei werden oft bestimmte „Pfade" gefolgt, die häufig auf der Unterseite gestürzter aber nicht ganz auf dem Boden aufruhender Baumstämme entlang führen. An solchen Stellen, die wegen ihrer häufigen Benutzung in der Tat leicht als „Wildpfade" zu erkennen sind, können die Tiere unschwer im Eisen gefangen werden. Einige der von meinem Vater ge-

sammelten Exemplare wurden von seinen Jägern erlegt als sie an einer bestimmten Stelle einen Waldpfad auf dem Boden überquerten.

Hylomys ist, soweit ich bis jetzt feststellen konnte, ein ausgesprochenes Tagtier.

Nahrung. In den Mägen einiger von mir gefangener Exemplare fand ich ganz fein zerkaute Insektenreste. Ein Stück, das ich einige Zeit lebend in der Gefangenschaft halten konnte, frass gern Heuschrecken, Grillen, Schaben, Engerlinge und Regenwürmer. Ein von mir im Eisen gefangenes Exemplar wurde einmal wahrscheinlich von einem Artgenossen angeschnitten, der sich bald darauf in demselben Eisen fing. Einige *Hylomys* habe ich gefangen in Eisen, die mit Grillen, grossen Käfern und grossen Holzschaben geködert worden waren. Andere fingen sich in mit Pisang, Ananas und Mais geköderten Eisen. Mein lebend gefangenes Stück verweigerte aber beharrlich jede Fruchtnahrung und ich halte es daher für wahrscheinlich, dass die im Eisen gefangenen Exemplare den Fruchtköder nur „inspizieren" oder auf Insekten Jagd machen wollten, die durch den Köder angezogen worden waren.

Wurf. Ein Weibchen mit 3 Embryonen gesammelt im November (Pasir Datar). Über die Brutpflege ist uns nichts bekannt.

3. Crocidura brunnea Jent.

Vorkommen. C. brunnea ist die auf Java am häufigsten vorkommende Waldspitzmaus. Mein Vater sammelte seinerzeit einige Exemplare bei Pasir Datar (Südwest-Abhang des Pangrango, ca. 1000 m ü.M.). Ich selbst konnte sie in den letzten Jahren in W.-Java an folgenden Örtlichkeiten feststellen: Umgebung von Pasir Datar (häufig), Tjiboeni oberhalb von Bandoeng, ca. 1400-1500 m ü.M. (häufig), Wijnkoopsbai, ca. 200 m ü.M. (einige Ex.). Ferner erhielt ich ein Stück von Rongkop an der Südküste M. Javas, ca. 100 m ü.M. Nach unseren Beobachtungen erstreckt sich also das Wohngebiet der Art auf Java von der Küste bis ca. 1500 m hinauf ins Gebirge. Die Fundorte sind teils sehr feucht (Pangrango, Tjiboeni), teils hingegen besonders trocken (Rongkop). Im Gebirge scheint die Art am häufigsten aufzutreten. Einige Male beobachtete ich diese Spitzmaus auch etwas ausserhalb des eigentlichen Waldes in Kina- und Teepflanzungen, aber nur an Stellen wo geeignete Schlupfwinkel (Baumstrünke) vorhanden waren. Ferner erhielt ich am Pangrango einmal ein Exemplar aus einem in der Nähe des Waldes gelegenen Bambushain.

Benehmen in der Freiheit. Mit Vorliebe hält *C. brunnea* sich im Walde unter und in der Nähe von gestürzten Baumstämmen auf. Namentlich solche, die teilweise nicht ganz auf dem Boden aufruhen, scheinen dabei bevorzugt zu werden. Unter solchen Stämmen entstehen infolge des Hin-und-her-laufens der Spitzmäuse deutliche „Pfade", auf denen die Tiere — ähnlich wie *Hylomys* — leicht im Eisen erbeutet werden können. Die Spitzmäuse scheinen unter solchen Stämmen und Strünken auch ihre Wohnhöhle anzulegen. Sie leben wahrscheinlich in der Regel paarweise.

Nahrung. Manche der von mir erbeuteten Stücke hatten sich in Eisen gefangen, die mit (toten) Grillen, grossen Käfern, grossen Holzschaben, sowie mit dem Fleisch von Skinken (*Mabuia*) geködert worden waren. Dieser Köder wurde von den Spitzmäusen auch tatsächlich angefressen. Normalerweise besteht die Nahrung wahrscheinlich zur Hauptsache aus kleinen Insekten, Spinnen, Würmern usw. aber ausserdem werden also in noch frischem Zustand aufgefundene Kadaver grösserer Tiere angenommen. Ich konnte dies auch zweimal für (kleine) Vogelkadaver feststellen.

4. **Crocidura bartelsi** JENT.

Vorkommen. Von dieser seinerzeit durch meinen Vater in Pasir Datar entdeckten Art erhielt ich in den letzten Jahren ein Exemplar von dem typischen Fundort und ein weiteres in Tjiboeni oberhalb von Bandoeng, ca. 1500 m ü.M. (det. SODY).

5. **Chironax melanocephalus** (TEMM.).

Vorkommen. Diese Fledermaus, die bisher nur nach 2 Exemplaren bekannt war, welche vor mehr als 100 Jahren durch KUHL und VAN HASSELT in „Bantam" gesammelt worden waren, haben wir einige Male angetroffen am Südwest-Abhang des Pangrango-Gede in ca. 1000 m Höhe. Sie lebt hier in den Urwäldern und hängt am Tage in kleinen Gesellschaften (beobachtet von 2 bis ca. 8 Stück) auf der Unterseite von Nestfarnen, die sich einige m über der Erde befinden.

Nahrung. Nach den ausgekauten Fruchtresten zu urteilen, die wir unter den von diesen Fledermäusen bewohnten Nestfarnen antrafen, scheint die Nahrung zu einem grossen Teil aus den Früchten von *Ficus ribes* zu bestehen.

6. **Coelops frithi** BLYTH.

Vorkommen. Von dieser seltenen Fledermaus erhielt mein Vater 1904 ein Stück, das sich abends auf Pasir Datar in unser Haus verflogen hatte. Ich selbst sammelte in den letzten Jahren eine grössere Serie in der Umgebung desselben Fundortes. Die Art ist eine typische Bewohnerin des Waldes und verbirgt sich hier am Tage einzeln und in kleinen Gesellschaften (beobachtet bis zu 16 Ex.) in hohlen Bäumen.

Wurf. Zwei Weibchen mit je einem kleinen Embryo erhalten im Januar und ein Weibchen mit kleinem Jungen im März (Pasir Datar).

7. **Nannosciurus melanotis melanotis** (MÜLL. & SCHLEG.).

Vorkommen. Die Verbreitung dieses Zwergeichhörnchens scheint auf Java eine sehr lokale zu sein [1]). Wir beobachteten die Art bisher nur am Südwest-Abhang des Pangrango (W.-Java), in etwa 1000 m Höhe ü.M. Das Vorkommen

[1]) Vgl. auch DAMMERMAN, Treubia, 13, 1931, p. 470.

des Tieres scheint hier eng gebunden zu sein an demjenigen einer Waldbaumart, von den Sundanesen dieses Gebietes „lengsar” (spr. längsar) genannt (*Pometia tomentosa*) [2]). Wir haben die Tiere nämlich fast immer ausschliesslich auf diesen Bäumen angetroffen, auf denen sie sich beinahe ständig aufzuhalten scheinen. Jedenfalls verbringen die Zwergeichhörnchen einen grossen Teil ihres Lebens auf diesen Bäumen. Man kann ein bestimmtes Pärchen — die Tiere leben nämlich fast immer paarweise — immer wieder auf demselben Längsarbaum beobachten. (In den Wäldern S.-Sumatras (wo der oben genannte Baum zu fehlen scheint), sah ich die dortige Rasse (*N.m. sumatranus* (Müll. & Schleg.)) gleich den grössern Eichhörnchenarten durch den Wald ziehen, ohne sich dabei in auffälligem Masse an einer bestimmten Baumart zu halten).

Benehmen in der Freiheit. Die Bewegungen dieses Tierchens sind äusserst rasch und nur selten sieht man es einen Augenblick stillsitzen. Während der Futtersuche an den Stämmen und Ästen und namentlich auch bei irgend einer Erregung, wird der Schwanz regelmässig ruckartig auf- und abwärts bewegt. Über die Brutpflege des Tieres ist uns nichts bekannt.

Stimme. Die Stimme dieses Eichhörnchens gleicht sehr einer der Gesangsarten eines in demselben Gebiet vorkommenden kleinen Vogels: *Pnoepyga pusilla rufa* Sharpe. Sie besteht aus einer Reihe schriller Pfeifentöne die in absteigender Tonhöhe ausgestossen werden. Ausserdem verfügt *Nannosciurus* auch noch über einen kurzen, meist mit kurzen Pausen öfters wiederholten Einzelpfiff, der etwa wie „tjick” klingt. Er ist vielleicht als Lockton aufzufassen, wird aber auch in der Erregung (z.B. bei einer Störung) ausgestossen und ausserdem wird er öfters gewissermassen als Einleitung zu dem oben beschriebenen Gesang während einiger Zeit zum besten gegeben.

Nahrung. Die Nahrung scheint am Pangrango grossenteils aus der Rinde des Längsarbaumes zu bestehen.

8. u. 9. **Petaurista petaurista petaurista** (Pall.) und **Petaurista elegans** (Temm.).

Vorkommen. Obwohl die grossen Flughörnchen typische Waldbewohner sind, traf ich einmal (August 1933) in der Nähe des Dorfes Simpar am G. Slamet (M.-Java) mehrere Exemplare der erstgenannten Art auf einigen hohen *Albizzia*-Bäumen in einer Kaffee-Anpflanzung, welche mehrere km vom nächsten Urwald entfernt war. Tagsüber verbargen die Tiere sich hier in Höhlungen von abgestorbenen *Albizzia*-Stämmen.

Die Angabe, dass der Typus von *P. elegans* aus Noesa Kembangan stammen soll, beruht sehr wahrscheinlich auf einem Etikettierungsfehler: *P. elegans* ist ein ausgesprochenes Hochgebirgstier.

Benehmen in der Freiheit. In der Nähe des obengenannten Dorfes am G. Slamet sah ich eines Abends zwei Exemplare von *P. p. petaurista* auf den dünnen

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[2]) Der wissenschaftliche Name dieses Baumes wurde mir gütigst von Herrn Dr. C. G. G. J. van Steenis-Buitenzorg mitgeteilt.

Wipfelzweigen eines hohen dürren *Albizzia*-Baumes sitzen, wobei die Tiere, obwohl ich ihre Silhouette gegen der sich dahinter befindenden Mondscheibe deutlich wahrnehmen konnte, so genau wie zwei grosse Eulen aussahen, dass ich sie dafür ansprach bis sie endlich ihren Platz wechselten und abschwebten. Die Tiere hatten also quer auf den Zweigen gesessen, sich mit allen vier Füssen (oder vielleicht auch nur mit den Hinterfüssen) daran festhaltend, und wahrscheinlich den Schwanz hochgekrümmt auf dem Rücken tragend.

Stimme. Die Stimme dieser Tiere ist ein klagendes Miauen, das man in ziemlicher Entfernung vernehmen kann. *P. elegans* verfügt ausserdem noch über einen „lachenden" Laut [1]).

Nahrung. Nach MÜLLER & SCHLEGEL soll die Nahrung vorwiegend aus Früchten, hauptsächlich solchen von *Ficus*-Arten bestehen [2]). Dasselbe berichten — wahrscheinlich auf Grund der Angaben der obengenannten Autoren — auch KONINGSBERGER, VAN BALEN und DAMMERMAN. In den Mägen von mehreren Exemplaren beider Arten, die ich untersuchte, liessen sich jedoch stets nur Blattreste feststellen. Früchte als Mageninhalt fanden wir niemals. Ich habe nur ein einziges Mal ein Flughörnchen (*P. p. petaurista* auf einem fruchttragenden Feigenbaum wahrgenommen, unterliess es aber leider das Tier zwecks Magenuntersuchung zu erlegen. Gegen eine ausgesprochene Fruchtnahrung spricht ja übrigens auch schon die Tatsache, dass diese Tiere gerade an Orten am häufigsten vorkommen, wo es nur sehr wenige, bzw. überhaupt keine Riesenfeigenbäume gibt.

Wurf. Ein Weibchen mit grossem Embryo erhalten am 15. Juli (Wijnkoopsbai).

10. **Hylopetes sagitta sagitta** (L.).

Vorkommen. In meiner Sammlung sind Exemplare dieses Flughörnchens vertreten aus Tjidaoen (Südküste von W.-Java), ca. 200 m ü.M., vom Tjitandoej (auf der Grenze zwischen W.- und M.-Java), 0 - 200 m, Goendih (Tiefland von M.-Java) und vom S.-Abhang des G. Lawoe (auf der Ostgrenze von M.-Java), ca. 1500 - 2000 m ü.M. Anfang Juni 1933 hatten E. BARTELS und ich Gelegenheit diese Tiere im Freien zu beobachten in Eingebornendörfern auf dem N.-Abhang des G. Karang in Bantam (W.-Java). Wir trafen sie hier auf Kokospalmen und andern Bäumen, u.a. Kapokbäumen an. Ferner beobachtete ich die Tiere im Juni 1936 gemeinsam mit Herrn P. J. BOUMA in den Teakwäldern bei Goendih und im Urwald am Lawoe.

Benehmen in der Freiheit. Das Auffallendste hieran ist die geradezu unglaubliche Schnelligkeit und die grosse Scheuheit dieser Tiere — im Gegensatz zu den langsameren und „bedächtigeren" Bewegungen und der geringen Vor-

[1]) Der Hautsegler, den JUNGHUHN im Ajang-Gebirge (O.-Java) beobachtete, und dessen Stimme er beschreibt („Java", 2. (Niederl.) Ausg., p. 1085) war wahrscheinlich *P. p. petaurista* oder *P. elegans* (nicht *Galeopterus variegatus*). Vgl. auch: l.c., p. 537. (*G. variegatus* hörten wir in der Freiheit niemals einen Laut von sich geben).

[2]) Verh. Nat. Gech. Ned. Overz. Bezitt., Zoöl., Zoogd., 1839, p. 112.

sichtigkeit der grossen Flughörnchen. Auch der Schwebflug schien uns schneller als derjenige der grossen Arten.

Hat man ein Exemplar entdeckt, so kostet es grosse Mühe es nicht sofort wieder aus den Augen zu verlieren. Die Tiere merken offenbar sehr bald, dass man sie verfolgt und bleiben dann, wenn sie zu einem andern Baum hinübergeschwebt sind, keinen Moment sitzen, sondern klettern sofort mit grösster Schnelligkeit hinauf in die Krone, um bald wieder zu einem anderen Baum hinüberzuschweben, usw. Wir sahen ein Exemplar am G. Karang auch einen p.m. horizontalen Flugsprung von einigen Metern ausführen.

Stimme. Ich hörte bisher von diesem Tier nur einen etwa wie „tschöck, tschöck" klingenden Laut, der oft mehrfach und in schneller Reihenfolge wiederholt wird. Er wird namentlich dann ausgestossen, wenn irgend etwas die Aufmerksamkeit der Tiere erregt hat. So vernahm ich ihn wenn die Tiere von mir abends oder nachts während der Futtersuche gestört worden waren und einmal wurde er (am Lawoe) ausgestossen, als eine Eule (*Phodilus badius badius* (HORSF.)) in die Nähe eines dieser Flughörnchen erschien. Der Laut war also in diesen Fällen wahrscheinlich als Warnton gemeint. Ein von mir in der Gefangenschaft gehaltenes Exemplar stiess jedesmal, wenn es auf irgend einer Weise erregt wurde (z.B. dadurch dass ihm ein grösseres Insekt lebend geboten wurde), ganz dieselben Laute aus. Scheinkämpfende (gefangene) Exemplare piepsten heiser, ähnlich wie es kämpfende Ratten zu tun pflegen.

Nahrung. Die Leute am G. Karang erzählten uns, dass die Tiere Kokosblüten frässen. Dass sie auch Kokosfrüchte annagen sollten, darüber wusste niemand uns etwas Bestimmtes mitzuteilen. Am G. Lawoe fing sich ein Exemplar in einem mit Pisang geköderten Eisen, das in etwa 1 m Höhe über der Erde auf einem morschen Baumstamm ausgesetzt worden war. Ein in der Gefangenschaft gehaltenes Stück, das völlig zahm im Zimmer umherlief und -kletterte, frass u.a. gern Pisang und Kokosnuss, aber am liebsten Insekten, wie Grillen, Heuschrecken, Schaben, ferner auch Spinnen. Es ergriff diese mit Blitzesschnelle mit dem Fang, dabei immer auch die Vorderfüsse zum erhaschen der Beute gebrauchend. Letztere benutzte es auch wie die Eichhörnchen beim Verzehren der Nahrung und sass wie diese dabei mit dem Schwanz auf dem Rücken hochgekrümmt.

Nest. Die Eingebornen am G. Karang erzählten uns, dass das Nest zwar in der Tat mitunter in Kokosnüssen gefunden werde, in die andere Eichhörnchen ein Loch genagt haben (wie dies in der Literatur bereits angegeben wurde), aber stets nur in schon v ö l l i g v e r d ü r r t e n Schalen, die entweder noch an dem Fruchtstiel festsitzen, oder sich davon losgelöst haben und irgendwo in der Palmkrone hängen geblieben sind.

Eingeborene Namen. „Entjang entjang" (spr. äntjang äntjang), Sundanesisch (G. Karang) [1]; „tjoekbo" (spr. tjuckbo), Sundanesisch (Tjitandoej).

[1]) Dieser Name wird schon durch MÜLLER & SCHLEGEL für Bantam erwähnt (Verh. Nat. Gesch. Ned. Overz. Bezitt., Zoöl., Zoogd., 1839, p. 113).

11. Petinomys genibarbis genibarbis (HORSF.).

Vorkommen. Ausser dem von HORSFIELD gesammelten Typus, der aus Poeger in O.-Java stammt, war von diesem auf Java anscheinend sehr seltenen Flughörnchen nur noch ein weiteres javanisches Exemplar (ohne genauere Fundortangabe) bekannt, das sich im Buitenzorger Museum befindet [1]).

Von Hernn P. J. BOUMA in Goendih (Tiefland von M.-Java) erhielt ich im Februar 1936 ein drittes Stück, das in dem dortigen Teakholzgebiet gefangen worden war. Es ist ein Weibchen, welches einen völlig entwickelten Embryo bei sich trug (der ebenfalls gut zum Balg verarbeitet werden konnte).

12. Rattus sabanus mayapahit ROB. & KLOSS.

Vorkommen. Diese Art wurde am 1. September 1903 von meinem Vater erstmalig auf Java gesammelt [2]). Er erhielt damals ein ♀ ad., das von einem Eingebornen bei der Anlage (beim Abgraben) eines Waldweges bei Pasir Datar im Neste gefangen worden war, welches sich etwa 1½ Fuss tief in der Erde befand. Da mein Vater den Fund jedoch nicht veröffentlicht hatte, blieb das Vorkommen der Art auf Java unbekannt, bis sie ROBINSON und KLOSS auf Grund einiger von ihnen selbst gesammelter Stücke 1919 für unsere Insel erstmalig in der Literatur erwähnten.

In den letzten Jahren konnte ich diese Ratte an folgenden Örtlichkeiten feststellen: am Südwest-Abhang des Pangrango (Umgebung von Pasir Datar), ca. 1000 m ü.M., im Küstengebirge an der Wijnkoopsbai und in Tjiboeni (oberhalb von Bandoeng), ca. 1400 - 1500 m ü.M.

13. Rattus surifer solaris SODY.

Vorkommen. Auch diese Art wurde erstmalig — am 11. Juni 1902 — von meinem Vater auf Java nachgewiesen. [3]) Später erhielt er dann noch zwei weitere Exemplare. Sie waren alle in den Teepflanzungen von Pasir Datar gefangen worden. Die Bälge existieren heute noch in unserer Sammlung. Der Fund blieb jedoch unveröffentlicht und so wurde die Art erst viel später, im Jahre 1921, durch KLOSS für Java erstmalig in der Literatur erwähnt.

In den letzten Jahren erhielt ich Exemplare dieser Art von folgenden Fundstellen: vom Südwest-Abhang des Pangrango (Pasir Datar und Umgebung), ca. 1000 m ü.M., von Tjiboeni (oberhalb von Bandoeng), ca. 1400 - 1500 m, aus dem Küstengebirge an der Wijnkoopsbai und aus der Landschaft Tjidamar an der Südküste W.-Javas. Diese Ratte lebt also sowohl im Tiefland wie im Gebirge. Sie ist eine Bewohnerin des Waldes, kommt aber stellenweise auch ausserhalb davon im angrenzenden Kulturland (Teepflanzungen) vor.

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[1]) Vgl. DAMMERMAN, Treubia, 13, 1931, p. 450.

[2]) Von meinem Vater in seinen Aufzeichnungen „grosse Langschwanzratte" genannt.

[3]) Von M. BARTELS Sr. in seinen Aufzeichnungen „rote Langohrratte" genannt.

Benehmen in der Freiheit. Nach meinem Dafürhalten ist diese Ratte — im Gegensatz zu manchen anderen Arten — ein ausgesprochenes Bodentier, das selten oder niemals Sträucher und Bäume erklettern dürfte. Darauf weisen u.a. auch die langen Hinterbeine und -füsse und der relativ kurze Schwanz hin.

Wurf. Ein Weibchen mit 5 Embryonen gesammelt im Mai (Pasir Datar).

14. **Pithecheirus melanurus melanurus** S. Müll.

Vorkommen. Diese Baumratte wurde von M. Bartels sr. und von mir und meinen Brüdern mehrfach angetroffen in den Urwäldern am Südwesthang des Pangrango-Gede in etwa 1000 m Höhe. Mein Vater erhielt einmal ein Exemplar, das von einem Eingebornen in ziemlicher Entfernung vom Wald auf einer Aren-Palme gefangen worden war.

Benehmen in der Freiheit. Im Gegensatz zu andern Ratten benimmt sich *Pithecheirus,* wenn sie bei Tag aufgescheucht wird, wenig scheu. Ihre Bewegungen sind langsamer und „bedächtiger" wie diejenigen anderer Ratten.

Durch E. Bartels wurde erstmalig beobachtet, dass diese Ratte einen typischen Greifschwanz besitzt. Als er nämlich eine von ihm gefangene Ratte in der Hand hielt, wickelte diese plötzlich das Schwanzende um einen Finger und hielt sich auf diese Weise daran fest. Und als ich ein anderes Exemplar aus seinem Nest aufgescheucht hatte und die Ratte den Zweigen des Nistbäumchens entlang kletterte, hielt sie sich ebenfalls an den Zweigen und an Blattstielen mit dem Schwanz fest, wenn sie an einem bestimmten Ort einige Zeit sitzen blieb. Das Schwanzende wurde dabei genau so um die Haltepunkte gewickelt, wie es die erste Ratte mit dem Finger getan hatte. Mit dieser Funktion steht es zweifellos in Zusammenhang, dass die letzten cm der Schwanzunterseite glatt sind.

Nahrung. Diese dürfte, nach dem Bau des Magens und des Darmes zu schliessen, vorwiegend aus Blättern bestehen. Ein von mir in der Gefangenschaft gehaltenes Exemplar frass gern Pisang, nahm aber auch Insekten (Grillen) an.

Wurf. Der Wurf dieser Ratte besteht nur aus einem einzigen Jungen (in 6 Fällen beobachtet). Wir fanden die Jungen in den Monaten April-September (je ein Fall in jedem dieser Monate).

Brutpflege. Pithecheirus bringt ihr Junge bekanntlich in einem Nest zur Welt, das zwischen den Zweigen niederer Bäume angelegt wird. Als wir einmal eine Mutterratte aus ihrem Nest hinausgescheucht hatten, hielt sich das Junge an ihr fest, wahrscheinlich indem es sich mit den Zähnen an einer Zitze und mit den Händen und Füssen an dem Pelz seiner Mutter festklammerte. Genau konnte dies nicht beobachtet werden, aber die Entdeckung von eigentümlichen scharfspitzigen bifiden Schneidezähnen bei dem Jungen liessen wenigstens das erstere mit grosser Wahrscheinlichkeit vermuten. Am 23. August 1933 sammelten dann meine Fänger eine Mutterratte mit ihrem bereits mehr als halbwüchsigen Jungen und dieses soll sich nach der Versicherung meiner Leute in der Tat mit den Zähnen an den Zitzen der Mutter

festgehalten haben. Diese zeigten denn auch eine Grösse und Länge wie ich sie noch bei keiner andern Ratte wahrgenommen habe (Länge des vorderen und des hinteren Paares resp. 4.5 und 7 mm). Die Mutter konnte sich in diesem Fall infolge der grossen Last nur langsam vorwärts bewegen und konnte dadurch leicht ergriffen werden. Das Junge hatte hier bereits die normalen Schneidezähne. Sein Gebiss war überhaupt schon gut entwickelt: die letzte Molare ist bereits sichtbar. (Kopf und Rumpf des Jungen 122 und der Mutter 171 mm).

Bekanntlich ist bei *Pithecheirus* die Schwanzbasis mit langen Haaren besetzt, eine Eigentümlichkeit, die wir in ähnlicher Form u.a. bei den Kuskusen wiederfinden. Sollte diese Eigenschaft vielleicht mit der Brutpflege im Zusammenhang stehen, in der Weise nämlich, dass diese Behaarung es dem Jungen ermöglichen sollte, sich hier festzuhalten? Auffallend ist ja auch die Übereinstimmung in der Jungenzahl: ebenso wie *Pithecheirus* bringen die Kuskuse nur ein einziges Junge zur Welt. Andererseits gewinnt diese Theorie dadurch, dass diese Behaarung auch bei den Männchen vorhanden ist, nicht an Wahrscheinlichkeit.

Herrn SODY, dem ich einmal eine junge Baumratte zusandte, fiel es auf, dass das Tierchen, obwohl es noch blind war (Kopf und Rumpf, nach der Messung von Herrn SODY, 73 mm) schon einen recht gut entwickelten Pelz besass. Dies dürfte nach seiner Ansicht ebenfalls damit im Zusammenhang stehen, dass das Junge offenbar von der Mutter auf der Nahrungssuche mit herumgetragen wird und nicht wie die Jungen anderer Ratten in dem Nest zurückbleibt.

Nest [1]). Im April 1933 fanden wir Zwei Nester dieser Ratte in etwa 1000 m Höhe am Südwesthang des Pangrango-Gede (an der Westgrenze der Plantage „Perbawati").

Nest Nr. I. Gefunden Mitte April, durch E. BARTELS. Es befand sich in etwa Kopfhöhe am Stamm eines mittelgrossen Baumfarns, der an einer ziemlich offenen Stelle an einem Waldpfad wuchs. Das Nest sass zwischen einem Stengel von einer Schlingpflanze und dem Farnstamm eingeklemmt und wurde auf diese Weise an seinem Ort gehalten. Es war ± kugelrund und bestand aus trocknen Baum- und Farnblättern und Fragmenten davon. Sein Durchmesser mag etwa 15 cm betragen haben. In dem Nest fand mein Bruder ein erwachsenes Weibchen, das keine Embryonen in sich trug und deren Mammae auch nicht entwickelt waren. Das Nest wurde in diesem Falle also vermutlich nur als Schlafgelegenheit benutzt.

Nest Nr. 2. Gefunden am 30. April im schattigen Hochwald auf der Nordseite des kleinen Waldsees „Sitoe Goenoeng", unweit vom Ufer. Das Nest stand hier im lichten Unterholz etwa 3.5 m über dem Boden. Es war auf dem dort ziemlich wagerecht wachsenden Stämmchen eines dünnen Bäumchens angelegt und wurde durch einige Stengeln von Kletterpflanzen an seinem Ort gehalten.

[1]) Ueber den Nestbau von *Pithecheirus* siehe auch: S. MÜLLER. Verh. Nat. Gesch. Ned. Overz. Bezitt., Zoöl., Zoogd., 1839, p. 36; JENTINK, Notes Leyd. Mus., 1895, p. 167; SODY, Zoöl. Meded. Mus. Nat. Hist. Leiden, 13, 1930, p. 139.

Infolge seiner wenig verborgenen Lage war das Nest leicht zu entdecken. Es war auch hier wieder ± kugelrund. Sein Durchmesser betrug ca. 15 cm. Die Nestwandung war auffallend dünn und wenig fest. Sie bestand aus trocknen Baumblättern, trocknen Blättern des Kletterbambus und Fragmenten von trocknen Nestfarnblättern.

15. **Arctogalidia trivirgata** subsp.

Vorkommen. Dieser merkwürdige Viverride gehört zu den am seltensten beobachteten und gesammelten grösseren Säugetieren Javas. Mein Vater erhielt 1904 ein ♂ ad. aus Tjidjangkar in der Mittelgebirgslandschaft bei Tjiandjoer (W.-Java). Ferner fand er einmal am Südwest-Abhang des Pangrango (W.-Java) in ca. 1000 m Höhe an einem Waldrand die Reste eines Exemplares, das einem Panther zur Beute geworden war [1]).

Ich selbst erhielt 1934 drei Stück aus dem Gebirge an der Wijnkoopsbai (W.-Java), ca. 200 m ü.M. Ferner beobachtete ich 1936 ein Pärchen bei Tjidaoen in der Landschaft Tjidamar an der Südküste W.-Javas (Meereshöhe höchstens 50 m).

Benehmen in der Freiheit. Zwei von den oben erwähnten an der Wijnkoopsbai erbeuteten Exemplaren (ein ♂ und ein ♀), hatten einer Gesellschaft von drei Exemplaren angehört, die sich ein altes Nest des grossen Eichhörnchens *Ratufa bicolor* zum regelmässigen Aufenthalt während des Tages ausgewählt hatten. Dieses Nest, das sich in etwa 20 m Höhe in der Krone eines mittelstarken Baumes befand, verliessen die Tiere erst gegen dem Hereinbrechen der Dunkelheit und entfernten sich dann sehr geschickt den Aesten und Zweigen entlang kletternd durch die Baumkronen der Umgebung. *Arctogalidia* scheint ein ausgesprochenes Baumtier zu sein. Auch die gut entwickelten Sohlen der Hinter- sowohl wie auch der Vorderfüsse deuten darauf hin. Ferner führt dieses Tier im Gegensatz zu *Paradoxurus hermaphroditus*, der auf Java nächst verwandten Art, eine ausschliesslich nächtliche Lebensweise und ist bis jetzt noch nicht in der Kulturlandschaft beobachtet worden.

Stimme. Mehrmals vernahm ich in dem Gebiet in dem ich die drei Exemplare erlegte und an andern Orten nachts ein langgedehnter, gewöhnlich mit kurzen Pausen öfters wiederholter miauender Schrei, der nach meinem Dafürhalten wahrscheinlich von *Arctogalidia* herrührt. Als das Weibchen eines von mir beobachteten Paares, — vielleicht beim Paarungsspiel —, seinen Halt verloren und von einem Zweig hoch über der Erde in den Unterwuchs des Waldes hinuntergestürzt war, lockte das Männchen (das ich im Scheine einer elektrischen Lampe deutlich als solches erkennen konnte) unablässig mit abwechselnd leise knurrenden und schnalzend-piepsenden Lauten, dabei aufgeregt über die Zweigen hin und her laufend und kletternd, bis das Weibchen wieder bis in seine Nähe heraufgeklettert war.

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[1]) Vgl. De Trop. Nat., 18, 1929, p. 82.

Nahrung. In dem Magen eines der von mir erbeuteten Exemplare fand ich Reste von kleinen Waldfrüchten.

16. **Arctictis binturong albifrons** Cuv.

Vorkommen. Am Südwest-Abhang des G. Pangrango in etwa 1000 m Höhe erhielten wir im Laufe von 40 Jahren nur 3 Stück dieser auf Java gewiss nicht häufigen Tierart. Ein weiteres Exemplar wurde von mir im gleichen Gebiet nur beobachtet (nicht erlegt). Ferner begegnete ich einem Muttertier mit einem etwa zweidrittel erwachsenen Jungen auf dem G. Masigit bei Tjibadak (W.-Java), ca. 400 - 500 m ü.M., und erlegte 1922 ein jüngeres Exemplar im Hügelland der Südküste unweit der Tjiletoehbai (W.-Java). In unserer Sammlung befindet sich schliesslich noch die Haut eines 1907 von meinem Vater bei Langgen im Hügelland nahe der Ostgrenze W.-Javas erlegten Exemplares.

Benehmen in der Freiheit. Der Bärmarder hält sich gern auf Bäumen auf, in denen er mit grosser Sicherheit aber etwas träge und bedächtig umherklettert. Er führt eine vorzüglich nächtliche Lebensweise, wurde aber von mir dreimal gegen 9 Uhr morgens noch bei der Mahlzeit überrascht. Zum Schlafen am Tage verkriecht er sich vielleicht nicht selten in Baumhöhlen. Das von meinem Vater bei Langgen erbeutete Exemplar zog sich nämlich, als es gestört wurde, in eine Baumhöhle zurück.

Nahrung. In fast allen oben erwähnten Fällen haben wir den „Binturung" auf fruchttragenden Riesenfeigenbäumen angetroffen. Die Früchte dieser Bäume pflegt er offenbar mit besonderer Vorliebe zu verzehren. Seine Losung deponiert er oft auf die stärkeren Aeste der von ihm besuchten *Ficus*-Bäume.

17. **Prionodon linsang gracilis** (Horsf.).

Vorkommen. Von diesem schwer zu erlangenden Tier erhielt mein Vater 1908 ein erwachsenes ♂ von Tjimenteng im Hügelland südwestlich von Soekaboemi (W.-Java), sowie ein etwa zweidrittel erwachsenes Junges von Pasir Datar am Südwest-Abhang des Pangrango (W.-Java), ca. 900 m ü.M. Die Bälge befinden sich noch in unserer Sammlung. Im Dezember 1922 beobachteten mein Bruder H. Bartels und ich am G. Parandje (spr. Parandjä) bei Tjiandjoer im Vorgebirgsland W.-Javas, wie ein bei unserem Herumklettern über die von üppigem Wald überwucherten Felsen dieses Bergrückens von uns zufällig aufgescheuchtes Exemplar nahe vor uns in ein Loch zwischen den Felsen verschwand. Ein weiteres Stück beobachtete E. Bartels 1936 eines Nachts (im Scheine einer „Eveready") im Urwald bei Sitoe Goenoeng am Südwest-Abhang des Pangrango-Gede, ca. 1200 m ü.M. Ferner zeigte mir Herr Plantagenaufseher B. H. Meintser eine von ihm angefertigte zweifelsfreie Skizze eines Exemplars, das im Urwald nahe des Gebirgssees Telaga Patenggang oberhalb von Bandoeng in einem für Waldhühner ausgesetzten Sprenkel gefangen worden war.

Benehmen in der Freiheit. Hierüber ist uns sogut wie nichts bekannt. Das von E. BARTELS beobachtete Stück lief mit marderartigen Sprüngen einem Waldweg entlang.

18. **Mustela lutreolina** ROB. & THOS.

Vorkommen. Dieses Wiesel wurde erstmalig am 29. April 1912 von M. BARTELS sr. auf Java gesammelt. Mein Vater erhielt damals auf der Plantage „Kaligoea" am G. Slamet (M.-Java), ca. 1500 m ü.M., ein etwa zweidrittel erwachsenes Stück, dessen Balg sich noch in unserer Sammlung befindet. Mein Vater erkannte gleich, dass es sich mindestens um eine für Java neue Art handelte [1]), er hat aber seine Entdeckung nicht veröffentlicht. Vier Jahre später erhielt ROBINSON in Tjibodas am G. Gede ein zweites Stück, nach dem dann die Art als überhaupt neu beschrieben worden ist. Auf der Plantage „Tjiboeni" oberhalb von Bandoeng (W.-Java), ca. 1500 m ü.M., fand E. BARTELS 1932 den noch gut erhaltenen Schädel eines eingegangenen Exemplars, der von SODY als zu *lutreolina* gehörig erkannt wurde (in coll. SODY). Schliesslich fand ich im Juni 1933 gemeinsam mit Herrn SODY auf dem Gipfel des G. Lawoe (auf der Grenze von M.- und Ost-Java) in über 3000 m Meereshöhe die Losung eines kleinen Raubsäugers (aus Haaren von *Rattus bukit lepturoides* SODY bestehend), die ich mit einiger Wahrscheinlichkeit diesem Wiesel zuschreiben möchte. Aehnliche, ebenfalls aus Rattenhaaren bestehende Exkremente fanden P. J. BOUMA und ich 1935 auch in der Gipfelregion des G. Slamet, in ca. 2500 m Höhe.

19. **Lutra** spec. [2]).

Vorkommen. Seitdem der angeblich aus Java stammende Typus von *Lutra barang* CUV. nach Europa gelangte, sind viele Jahre verflossen, ehe das Vorkommen einer zweiten Otter-Art (neben *L. cinerea*) auf Java bestätigt werden konnte. Der neue Nachweis gelang im Jahre 1908 meinem Vater, als er von der Nordküste bei Batavia ein junges Exemplar eines grossen „langkralligen" Otters erhielt, das längere Zeit von ihm in der Gefangenschaft gehalten wurde, bis es einging, und dann (als etwa zweidrittel erwachsenes Tier) unserer Sammlung einverleibt wurde Der Balg existiert noch heute, der Schädel ist leider verloren gegangen. Später wurde dann die Art noch einige Male von meinem Vater im Tjitaroem-Delta beobachtet und regelmässig wurden an den Flussläufen und in den Morästen dieses Gebietes die unverkennbaren Fussspuren des Tieres gefunden. Mein Vater hat seine Beobachtungen jedoch nie veröffentlicht und die Art taucht daher erst viel später, und zwar als SPENNEMANN sie

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[1]) Auf der Etikette von meinem Vater handschriftlich vermerkt: „voor zoover bekend het eerste op Java verzamelde exemplaar".

[2]) Die systematische Stellung dieses Tieres ist noch nicht völlig geklärt; ich führe die Art daher an dieser Stelle nur unter dem Genusnamen auf.

1925 an der Nordküste bei Indramajoe (W.-Java) feststellte, für Java erstmalig wieder in der Literatur auf [1]).

In den letzten Jahren hat sich nun herausgestellt, dass der „grosse Otter" auch an der Südküste nicht einmal so ganz selten vorkommt. Herr R. H. A. VAN MAARSEVEEN erbeutete nämlich in den Jahren 1933 und 1936 je ein Exemplar am Tjipandak bei Tjidaoen (Residentschaft Preanger-Regentschappen, W.-Java [2]), ich selbst beobachtete sie und sammelte ein Stück 1934 gemeinsam mit Herrn P. J. BOUMA am Tjitandoej (auf der Grenze von W.- und M.-Java) und schliesslich glückte es 1935 meinem Bruder E. BARTELS und mir bei Pangandaran (wie oben) 2 Exemplare zu erbeuten.

Flache, von dauernd oder zeitweise brackischen Flussläufen durchzogene Morastwälder sind die bevorzugten Aufenthaltsorte dieses Otters. Die Wasserläufe müssen dabei eine dichte Ufervegetation aufweisen. Nur an einem der bis jetzt bekannten Fundorten (Tjipandak) ist das Gelände nicht ganz flach und der betreffende Flusslauf steinig und nur in diesem Fall befand sich der Aufenthaltsort der Otter ausserhalb des Wirkungsbereiches der Gezeiten. Die Entfernung von der See beträgt aber auch für den am weitesten landeinwärts gelegenen Fundort bloss einige km. Im Binnenland ist die Art bisher noch nicht festgestellt worden.

Benehmen in der Freiheit. Nach unseren gemeinsamen Beobachtungen jagen die Otter regelmässig auch am Tage, und zwar vorwiegend während der frühen Morgen- und der Nachmittagsstunden. Am Tjitandoej traf ich das von mir erlegte Exemplar nachmittags gegen ½ 5 Uhr fischend an. Ferner wurde in demselben Gebiet eine Gesellschaft von mindestens 5 Stück zweimal gegen 3 - 4 Uhr nachmittags beim Fischfang beobachtet. Nach Aussage der Eingeborenen — und unsere eigenen Beobachtungen sprechen für die Richtigkeit ihrer Behauptung — sollen die Otter im Tjitandoej-Gebiet, wo sich die Wirkung der Gezeiten bis mehrere km landeinwärts noch sehr deutlich bemerkbar macht, namentlich während des Eintritts von Ebbe und Flut zur Jagd ausziehen und zwar in der Weise, dass sie beim Beginn der Ebbe flussaufwärts und beim Eintritt der Flut flussabwärts ziehen. Namentlich in den seichteren Nebenflüsschen ziehen die Fische nämlich mit dem Wasserstrom mit und die Otter sollen nun regelmässig ihre Jagd in der dem Fischzug entgegengesetzten Richtung ausüben. Ich konnte einmal von einem Ansitz über dem Ufer aus genau beobachten wie die Räuber dabei vorgehen. Es handelte sich um die oben erwähnte 5-köpfige Gesellschaft. Das Herannahen der Otter wurde, als die Tiere noch ziemlich weit entfernt waren, durch ihre oft ausgestossenen piepsend-fauchenden Zanklaute angekündigt. Ich konnte nun bald die Tiere selbst wahrnehmen, wie sie in ziemlich raschem Tempo im Wasser schwimmend dem Ufer entlang zogen, immer wieder den Kopf zum Luftschöpfen kurz aus dem Wasser steckend und sofort wieder untertauchend und weiter schwimmend. Der zurückgelegte Weg

[1]) Vgl. De Trop. Nat., 16, 1927, p. 208.

[2]) Herr VAN MAARSEVEEN schenkte mir liebenswürdigerweise den Schädel eines der von ihm erlegten Exemplare.

war deutlich wellenförmig. Die Tiere hielten sich dabei in zwei Gesellschaften getrennt auf beiden Seiten des schmalen Wasserlaufes. Auf der einen Seite schwammen zwei erwachsene Exemplare, auf der andern ein erwachsenes Tier und etwa zweidrittel erwachsene Junge. Einige Zeit nachdem die Tiere an mir vorübergezogen, kamen sie aus der entgegengesetzten Richtung zurück, jetzt mit dem Wasserstrom mit und diesmal anscheinend nicht jagend. Das Ergreifen der Fische wird wahrscheinlich oft dadurch erleichtert, dass die Beute zuerst zwischen die ins Wasser herabhängenden Stelzwurzeln der Uferbäume in die Enge getrieben wird. — Mein Vater konnte einmal feststellen, dass eine Gesellschaft Otter sich nachts zum Fischfang ziemlich weit ausserhalb einer Flussmündung in die (allerdings hier nicht tiefe) See hinaus begeben hatte.

Ebenso wie *L. cinerea* scheint die grosse Art hauptsächlich in kleinen Trupps von etwa 4 - 5 Stück zu leben. VAN MAARSEVEEN beobachtete jedoch am Tjipandak einen „Einzelgänger", der sich als altes Männchen erwies, als er endlich erlegt werden konnte. Um die gleiche Zeit trieb sich nach dem genannten Beobachter in demselben Gebiet eine Gesellschaft von 6 Ottern herum.

Werden die Tiere bei der Jagd gestört, so flüchten sie entweder untertauchend durch das Wasser, oder sie gehen an Land und suchen auf dem Trocknen dem Ufer entlang zu entfliehen, letzteres aber wahrscheinlich in der Regel nur, um bald wieder ins Wasser zurückzukehren. Jagdhunden gegenüber benehmen sich die Otter besonders mutig. Mein Bruder E. BARTELS machte einen Fall mit, in dem ein Hund von einem gejagten Otter arg zerbissen wurde.

Nahrung. Im Magen eines erlegten Exemplares fand ich Reste eines grossen Fisches.

Brutpflege. Die Jungen werden wahrscheinlich zwischen der dichten Vegetation (nicht in einer Höhle) zur Welt gebracht.

Eingeborene Namen. „Andjing aer" (spr. aär), Malayisch: „Wasserhund" (Tjitaroem Delta); „sero galang" (spr. säro), Sundanesisch: „sero" = „otter", „galang" ? (Tjitandoej-Gebiet) [1]); „linsang", Javanisch (Tjitandoej-Gebiet).

20. **Pithecus aygula fredericae** SODY.

Vorkommen. Diese erst 1930 beschriebene Rasse wurde bereits 1910 - 1912 von meinem Vater in der Nähe der Plantage „Kaligoea" am S.-Abhang des G. Slamet (M.-Java), ca. 1500 m ü.M., beobachtet. An der Stimme erkannte er gleich, dass es sich um eine Subspezies von *aygula* handelte. Er hat aber damals von den von ihm beobachteten Affen keinen erlegt. Ihre grosse Verschiedenheit von der typischen Form war ihm jedoch sofort aufgefallen.

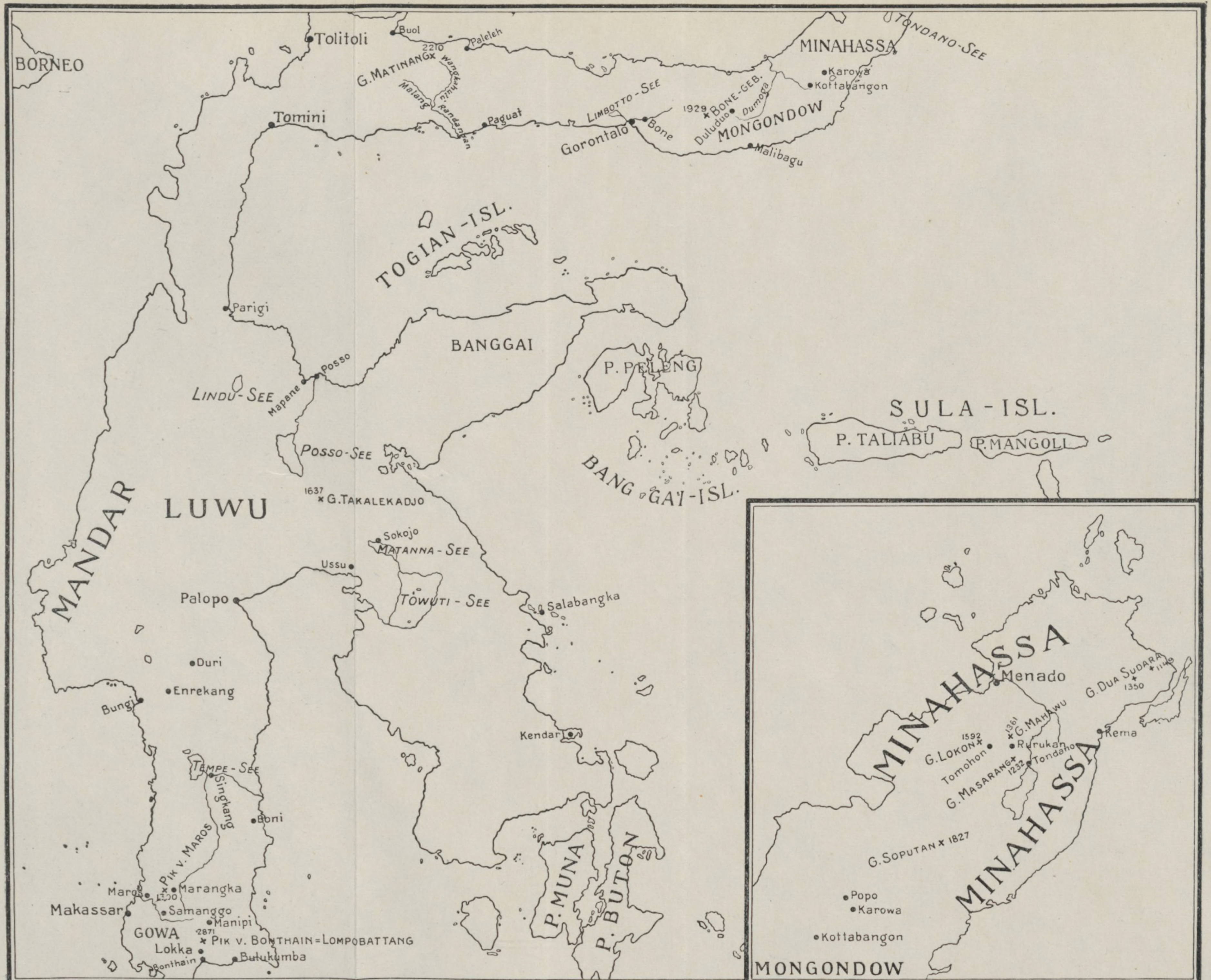
In den letzten Jahren erhielt ich 3 Exemplare dieses Tieres von der Plantage „Pagilaran" auf der Nordwestseite des Diëng-Gebirges (M.-Java), ca. 1300 -

[1]) Der „sero galang" ist auch im Binnenlande W.-Javas unter den Sundanesen — dem Namen nach — allgemein bekannt; er soll grösser sein als der gewöhnliche Otter (*L. cinerea*) und im Gegensatz zu diesem „nur paarweise" (nicht in Trupps) vorkommen. Der grosse Otter ist jedoch, wie bereits bemerkt wurde, bisher im Binnenlande noch nicht festgestellt worden.

1500 m ü.M., die freundlichst durch Hernn K. LANDBERG, Aufseher auf der genannten Plantage, für mich gesammelt worden waren.

Benehmen in der Freiheit. Herr LANDBERG beobachtete in Pagilaran mehrmals einen kleinen Trupp dieser Affen, der sich einer bedeutend kopfreicheren Gesellschaft von „Loetoengs” (*Pithecus pyrrhus*) angeschlossen hatte. Die Tiere hielten sich in einem steilen Tal auf, der mit einem dichten sekundären Wald in dem da und dort kleine Urwaldreste stehen geblieben, bedeckt war. Jedesmal, wenn die Affen bemerkt hatten, dass sie verfolgt wurden, sprangen sie in den Unterwuchs des Waldes hinunter und suchten durch das dichte Gebüsch, wahrscheinlich zum Teil auch über den Boden laufend, zu entfliehen.

Eingeborener Name. „Rekrekan” (spr. räckräckan), Javanisch: nach der Stimme (Pagilaran).



K. GÜNTHER: *Acrididae Celebicae.* — Uebersichtskarte von Celebes.

ORTHOPTERA CELEBICA SARASINIANA.

Fam. **Acrididae,** Subfam. **Acrydiinae.** [1])

Von

KLAUS GÜNTHER

(Museum für Tierkunde, Dresden).

Durch die Liebenswürdigkeit des Herrn Professor Dr. HANDSCHIN in Basel ging mir die dem dortigen Museum gehörige Acrydiinenausbeute zu, die die Herren Dres. F. und P. SARASIN während ihrer berühmten Durchforschung der Insel Celebes zusammen brachten. Dieses Material umfasst 9 Arten, von ihnen sind 5 bisher der Wissenschaft nicht bekannt. Eine sehr glückliche Ergänzung dazu bildet die Ausbeute des Herrn HEINRICH, der 1930 - 1932 auf Celebes reiste; Herr Professor Dr. RAMME vom Zoolog. Museum Berlin vertraute sie mir gütigst an. Sie enthält auch 9 Arten, von denen 4 weitere über die genannte Zahl hinaus bisher unbekannt sind. Schliesslich sind hier noch von FRUHSTORFER gesammelte Celebes-*Acrydiinae* heran gezogen worden (in den Museen Hamburg, Stettin und Wien), und auch unter ihnen finden sich noch 5 weitere neue Formen. Besonderen Dank schulde ich den Herren Prof. Dr. O. LUNDBLAD vom Naturhistorischen Museum in Stockholm und Herrn Dr. BEIER vom Naturhist. Museum in Wien, die mir viele der in ihren Abteilungen aufbewahrten Acrydiinentypen zugänglich machten; ohne diese wertvolle Hilfe hätte ich mit nur sehr geringem Erfolge über *Acrydiinae* zu arbeiten versuchen können.

Die Acrydiinen sind von Herrn WILLEMSE in seiner Darstellung "Orthoptera Sarasiniana, I, Saltatoria, fam. *Acrididae*" (Treubia XII, Suppl., 1931, pp. 192 - 202) bereits mitbehandelt worden, doch konnte die Bearbeitung dieser Gruppe mangels so reichlichen Vergleichsmaterials, wie es dafür notwendig ist und mir heute zur Verfügung steht, damals nur cursorisch vorgenommen werden, auf Neubeschreibungen wurde verzichtet. Damals konnten in der erwähnten Arbeit 48 Acrididenarten insgesamt, von denen 7 neu zu beschreiben waren, für Celebes bekannt gemacht werden. Hier können, von der subfam. *Acrydiinae* allein, 27 Arten und Unterarten aufgeführt werden, von denen 13 als neu anzusehen sind; dazu kommen noch 5 von Celebes erwähnte, aber mir von dort nicht vorliegende Arten, so dass von der Acrydiinenfauna der Insel Celebes heute 32 Arten bekannt sind. Diese verteilen sich auf 18 Gattungen, deren 2 neu zu errichten waren.

[1]) *Vide*: Treubia, XII Suppl., Mai 1931, p. 1 - 3.

Zoogeograpische Uebersicht.

Im allgemeinen scheinen die Acrydiinen keine dankbare Grundlage für zoogeographische Untersuchungen abgeben zu wollen; die Mehrzahl ihrer Arten, zumal in Südostasien, ist über sehr weite Gebiete verbreitet, wobei einige Arten freilich geographische Rassen ausbilden. Doch ist die Einsicht in diese Verhältnisse erschwert, da ein erwünschtes einheitliches Bild solcher vicariierender Rassen mitunter verschleiert erscheint durch das Auftreten von bei Orthopteren auch anderwärts beobachteter sogen. "Phasen", verschiedener Erscheinungsformen der selben Art auf jedenfalls nicht geographischer Grundlage. Die beträchtlichen Schwierigkeiten, die die Systematik der Acrydiinen an sich schon bietet, sollen hier nur erwähnt sein, weiter unten werden sie in Einzelfällen beleuchtet.

Immerhin zeigt für Celebes die nachstehend gegebene Tabelle mit einer Uebersicht über das Gesamtvorkommen der bisher auf der Insel gefundenen *Acrydiinae* 8 - 9 Formen, die nirgend hin nähere verwandtschaftliche Beziehungen haben, das sind 25 - 28 % des gesamten Artenbestandes; die endemischen Formen überhaupt machen 60 % der Gesamtzahl der gegenwärtig von Celebes bekannten Arten und Unterarten aus. 3 Formen, 9,4 % der Gesamtzahl, sind als östliches, nach Neuguinea und Australien tendierendes Faunengut an zu sehen; 3 weitere, wieder 9,4 % haben die nächsten Beziehungen nach den Philippinen.

Uebersicht über die Gattungen.

Die systematischen Verhältnisse in der Unterfamilie der *Acrydiinae* werden von allen, die bisher in dieser Gruppe arbeiteten, als ungemein schwierig geschildert, und das Verlangen nach Revision und Neubearbeitung ist allgemein; obwohl eine grosse Anzahl von Forschern sich den *Acrididae* widmet, werden doch fast überall, auch in grösseren Gesamtdarstellungen und oft stillschweigend, die *Acrydiinae* bei Seite gelassen. Beschäftigt man sich eingehend und länger mit dieser Gruppe, wie es der Autor versucht, wird man Gelegenheit finden zu bemerken, dass die Schwierigkeiten in der Tat ungeheuer sind, dass sie beim Versuch, sie aufzulösen, immer stärker zu werden scheinen, und dass sie wahrscheinlich durch Fassung der Gruppe in ein festes systematisches Gebäude welcher Art immer, wie man es an anderen Stellen des Tierreiches so glücklich anwenden kann, nicht überwunden werden können. Die Einteilung in die von BOLIVAR 1887 aufgestellten Sectionen erweist sich auf Schritt und Tritt als unzulänglich; aber sie erscheint höchstens durch eine andere, nicht durch eine bessere ersetzbar. Im kleinen ist es mangels aller Sicherheit in den Merkmalen oft unmöglich, die Gattungen zu definieren und gegeneinander abzugrenzen, und die äusserlich zunächst verschiedensten weit entfernt von einander im BOLIVARschen System stehenden Arten sind durch Uebergangsformen verbunden. Weiter unten wird z.B. bei der Behandlung der Gattung *Tegotettix* HANC. im einzelnen eine derartige verwirrte Situation vorgeführt werden.

+ Sonstiges Vorkommen der gleichen Form. × Nächst verwandte Form.
— Keine näheren Beziehungen.

	Sumatra Java Borneo	Philippinen	Kleine Sunda-Inseln	Molukken, Kei Inseln	Aroe, N.Guinea, Nordaustral.	Indien Mal. Halbins., Südchina
Kraengia apicalis	—	—	—	—	—	—
Ophiotettix cygnicollis	—	—	—	—	+N.G.	—
Hirrius sarasinorum	—	—	—	—	—	—
— *montanus*	—	—	—	—	—	—
— *scrobiculatus*	—	×	—	—	—	—
Criotettix bispinosus ssp. [1])	×	×	—	—	—	—
Eugavialidium celebicum	—	×	—	—	—	—
Tegotettix armatus [2])	+Borneo	—	—	—	—	—
— *tuberculatus* [2])	—	—	—	—	—	—
— *corniculatus celebensis*	×Borneo	×	—	—	N.G.	—
Bullaetettix sarasinorum	—	—	—	—	—	—
Tondanotettix brevis brevis	—	—	—	—	—	—
— *brevis meridionalis*	—	—	—	—	—	—
— *modestus*	—	—	—	—	—	—
Pseudoparatettix luwuensis	—	—	—	—	—	—
Loxilobus insidiosus	+	+	—	—	—	+Malaya
— *rugosus celebensis*	×Borneo	—	—	—	—	—
Mazarredia celebica	?×[3])	—	—	—	—	? Indien
Spadotettix heinrichi	—	—	—	—	—	? Ceylon
Systolederus carli celebensis	—	×[4])	—	—	—	—
— *fruhstorferi*	—	—	—	—	—	—
— *ophthalmicus*	—	—	—	—	—	—
Coptotettix alfurus	—	—	—	—	—	×
— *interruptus*	+	—	—	—	—	—
Euparatettix celebicus	×	+	—	—	×	×
— *personatus*	+	+	+	+	+	+
Paratettix histricus	+	+	+	+	+	+
— *femoralis*	—	—	—	+	+	—
— spec.						
Indatettix spec.						
Hedotettix costatus	×	×	—	—	—	+Malaya
— *gracilis*	+	×	—	—	—	+Indien

[1]) Die Form ist von allen anderwärts vorkommenden Rassen des *C. bispinosus* wohl unterschieden; sie wird hier nicht benannt, da noch nirgend die geographischen Rassen dieser Art geklärt sind und auch der systematische Wert der als nächst verwandte selbständige Species beschriebenen Arten unbekannt ist.

[2]) *Tegotettix armatus* Hanc. und *T. tuberculatus* Bol. sind vielleicht mit einander identisch.

[3]) Bei der Beschreibung der *Mazarredia ophthalmica* 1909, die Rassen auf Sumatra, Borneo und Java hat, nennt Bolivar als die ihr ähnlichste Art die *M. celebica* Bol., die auch nach der Beschreibung vielleicht nicht mehr als eine Rasse der nordindischen *M. ophthalmica* ist.

[4]) Die Philippinenform des *Systolederus carli* 1909 liegt aus dem Zool. Mus. Berlin vor, ist aber noch nicht beschrieben.

Bei der folgenden Gattungstabelle sind an den entsprechenden Stellen in Klammern, ohne in die eigentliche Tabellenfolge aufgenommen zu sein, angeführt solche Genera, von denen Angehörige auf Celebes zur Zeit nicht bekannt sind, dennoch aber eines Tages auch von dort bekannt werden könnten; diese Einrichtung wird die folgende Tabelle vielleicht von gewissem Nutzen auch bei dem Studium sonstigen indoaustralischen Acrydiinenmateriales erscheinen lassen. Denn der Gebrauch der HANCOCKschen Gattungstabellen dürfte noch bedeutend schwieriger und erfolgloser sein, als, wie der Autor wenigstens hofft, es bei der hier gegebenen Tabelle der Fall sein möchte.

1. Fühlerglieder normal, rund, glatt, gestreckt und dünn, oder kürzer und dicker .... 4.
— Wenigstens einige Fühlerglieder deutlich comprimiert und verbreitert, zuweilen blattförmig und an den Seitenrändern gesägt .... 2.
  (Mehrzahl der Fühlerglieder distalwärts deutlich dreikantig. *Tripetalocera* WESTW.).
2. Fühlerglieder mit Ausnahme der ersten 4 oder 5 gleichmässig distalwärts schwach verbreitert, an den Seiten schwach gezähnt. Fühler kurz, Pronotum kaum das Abdomen nach hinten überragend, mit mehreren Höckern und stark erhabenem Mittelkiel. Keine Flugorgane .... *Kraengia* BOL.
  (Pronotum überragt die Hinterschenkelenden deutlich, meist mit Höcker oder fingerförmigem Stachel mitten am Vorderrand, auch sonst bewehrt, Flugorgane vorhanden .... *Discotettix* COSTA.
  Seitenrand der Fühlerglieder glatt, wenigstens 10., 11. oder 11. und 12. der distal sehr gestreckten Fühlerglieder distal fast unmerklich verbreitert.
  Kopf nicht verlängert .... *Mazarredia fuscipes* STAAL.
  Kopf sehr stark verlängert .... *Ophiotettix* WLKR.).
— Die überhaupt comprimierten Fühlerglieder sind nicht gleichmässig oder schwach comprimiert: stets sind einige von ihnen, das 9. und 10., oder 8.-10., auch das 7.-9. oder 11. und 12., stärker, zuweilen fast blattartig, comprimiert, mitunter auch an den Seitenrändern gesägt .... 3.
3. Kopf sehr verlängert und stark verengt hinter den Augen, die hoch über das Pronotum erhoben sind .... *Ophiotettix* WLKR.
— Kopf nicht verlängert und nicht erhöht, Pronotum glatt, ohne Höcker und Stacheln; Schultern glatt, Fläche höchstens mit unscharf begrenzten ± deutlichen Einsenkungen. Pronotumseitenlappen mit deutlich auswärts gekehrten Hinterecken; Flugorgane vorhanden, oder (bei Arten ausserhalb von Celebes) fehlend .... *Hirrius* BOL.
  (Pronotumseitenlappen mit deutlich wie bei *Hirrius* auswärts gekehrten Hinterecken, aber Pronotum mit Stacheln und Dornen ... *Discotettix* COSTA, *Arulenus* STAAL.
  Hinterecken der Pronotumseitenlappen anliegend, Pronotum glatt, schwach dachförmig .... *Phaestus* BOL.).
4. Stirnkiele unterhalb der Augen sehr weit, weiter als das 1. Fühlerglied breit ist, gegabelt, meist gedrungene Tiere mit recht auffällig gestaltetem Pronotum. Zahlreiche Gattungen, bisher nicht auf Celebes gefunden. (Sectio Cladonotae BOL.).

— Stirnkiele nicht weiter, als das 1. Fühlerglied breit ist, gegabelt, aber die 4 vorderen Schenkel oben nicht gekielt, sondern deutlich gefurcht; Pronotum oben über den Scheitel des Kopfes hinweg nach vorn verlängert. Nur 3 Gattungen in Indo-australien (*Saussurella* BOL., *Palaioscaria* GTHR., *Vingselina* SJÖST.), bisher nicht von Celebes bekannt.

(Sectio Batrachidae BOL.).

— Stirnkiele unterhalb der Augen schmal gegabelt, jedenfalls nicht weiter, als das 1. Fühlerglied breit ist, und die 4 vorderen Schenkel oben gekielt, keinesfalls deutlich gefurcht .... 5.

5\. Seitenlappen des Pronotums, von der Seite gesehen, am Ende unten meist spitz abgerundet, von oben gesehen, nicht nach aussen gewendet, zumindest nicht so weit, dass er die Deckstücke der Mittelhüften (Mesopleuren) nach aussen überragt .... 18.

— Seitenlappen des Pronotums, von der Seite gesehen, am Ende nach hinten abgeschnitten oder ganz breit verrundet; von oben gesehen, nach aussen gewendet, so dass er zumindest die Deckstücke der Mittelhüften (Mesopleuren) nach der Seite hin überragt. Dieser auswärts gewendete Teil des Pronotumseitenlappens kann, von oben gesehen, die Form einer stumpfen oder spitzen Schuppe haben, oder in einen ± langen, graden oder gekrümmten Dorn ausgezogen sein, vor dem noch ein zweiter stehen kann .... 6.

6\. Pronotumseitenlappen in einen Dorn oder in eine deutliche, spitze (mitunter 2-spitzige) Schuppe nach der Seite hin ausgezogen und Scheitel breiter oder so breit wie eines der stark nach der Seite heraus stehenden Augen; oft innen neben den Augen kleine über sie hinaus ragende Hörnchen. Antennen tief unterhalb der Augen eingelenkt; Hinterschienen ohne oder mit nur ganz wenigen, fast obliterierten Dörnchen. Meist grosse Tiere, mit stark verlängertem Pronotum .... 7.

— Pronotumseitenlappen in einen Dorn oder eine deutliche, spitzwinklige Schuppe ausgezogen (nie 2-spitzig); Scheitel nicht schmäler, meist breiter als ein Auge, nie mit die Augen überragenden Dörnchen; Antennen zwischen den unteren Augenrändern oder höher eingelenkt; Hinterschienen mit deutlichen zahlreichen Dörnchen auf beiden Kanten. Kopf nicht exseriert, Augen kaum über das meist stark verlängerte Pronotum nach oben ragend 9.

(Mit ± stark exseriertem Kopf und deutlich über das Pronotum ragenden Augen.

a Scheitel so breit oder kaum schmäler als ein Auge ... *Eucriotettix* HEB.

b Scheitel sehr viel schmäler als ein Auge, etwa nur ½ so breit.

Bolotettix HANC., *Systolotettix* HEB.

c Scheitel vorn schmäler als das 1. Antennenglied ...... *Systolederus* BOL.).

— Seitenlappen des Pronotums, von oben gesehen, nur in Gestalt einer kurzen und stumpfwinkligen Schuppe nach aussen gewendet, dabei nur ganz wenig die Deckstücke der Mittelhüften (Mesopleuren) nach aussen überragend 10.

7\. Seitenlappen des Pronotums am Ende in einem langen graden oder hakig nach vorn gekrümmten Dorn ausgezogen, ohne weiteren Dorn; hinterer Metatarsus nicht, wie in ihrem distalen Ende die dornenlosen Hinterschie-

nen, lamellenartig verbreitert. Pronotum, von der Seite gesehen, ohne grössere Erhebungen, Scheitel stets ohne über die Augen ragende Dörnchen. Grosse Tiere mit stark verlängertem Pronotum, ohne grosse Lappenzähne an den 4 vorderen Schenkeln .... *Eugavialidium* HC.

(Ebenso, aber hintere Metatarsen wie die Hinterschienen am Ende stark lamellenartig verbreitert .... *Scelimena* SERV.
3. Hintertarsenglied der ♀♀ schwach aber deutlich verdickt, Seitenlappendornen nach vorn gekrümmt. In den ♂♂ von *Eugavialidium* nicht zu trennen. *Falconius* BOL.).

— Seitenlappen des Pronotums am Ende in eine breite und grosse deutlich spitzwinklige Schuppe ausgezogen, die am Vorderrande höckerig sein kann; endet der Seitenlappen in einen — ± hakig nach vorn gekrümmten — deutlichen Dorn, steht unmittelbar vor diesem am Vorderrande des Seitenlappens ein weiterer deutlicher Dorn. Sehr oft mit die Augen nach vorn oder oben überragenden Scheitelhörnchen. Der Hinterrand des Pronotumseitenlappenzipfels (hinter der äusseren Spitze oder hinter dem äusseren, resp. dem zweiten Dorn) kann sehr deutlich und tief ausgerandet sein Auf dem Pronotum stehen grössere, zuweilen sehr grosse Unebenheiten, Höcker und dergl. in Ein- oder Mehrzahl; Schulterdornen können vorhanden sein. Deutliche Zähne, oft grosse Lappenzähne an den 4 vorderen Schenkeln .... 8.

8. Pronotumseitenlappen in eine spitze oder stumpfwinklige grosse Schuppe am Ende ausgezogen, nicht in einen deutlichen ± gekrümmten Dorn, ohne deutlichen Dorn am Vorderrande dicht vor der äusseren Spitze des Seitenlappens. Scheitel stets mit die Augen überragenden Scheitelhörnchen, Pronotum fast stets (auf Neuguinea undeutlich) mit zumindest einer grossen höckerartigen Erhebung des Mittelkieles zwischen den Schultern, zuweilen mit mehreren grossen Höckern hinter einander. An den 4 vorderen Schenkeln Zähne, zuweilen grosse Lappenzähne mit gesägten Rändern. *Tegotettix* HANC.

(Aehnlich, aber ohne deutlich über die Augen ragende Scheitelhörnchen, Pronotum ± glatt, zumindest Mittelkiel nirgends mit beträchtlich grossen Höckern .... Manche Arten von *Eugavialidium* HANC.
♀♀ mit verdickten 3. Gliedern der Hintertarsen, ♂♂ von *Eugavialidium* nicht zu unterscheiden .... *Falconius* B.
Pronotum verkürzt, höckerig und in Profilansicht gewölbt, hinten ausgeschnitten. Celebes .... *Tondanotettix* WILLEMSE).

— Seitenlappen des Pronotums in einen deutlichen nach vorn gekrümmten Dorn auslaufend; unmittelbar vor diesem steht ein kleinerer aber deutlicher zweiter Dorn. Scheitelhörnchen ± deutlich, die 4 vorderen Schenkel mit Lappenzähnen, Pronotum oben meist mit grösseren oder kleineren Höckern, aber nie mit einem grossen Mittelkielhöcker zwischen den Schultern oder mehreren Mittelkielhöckern. Hinterschienen distalwärts kaum, hintere Metatarsen nicht verbreitert .... *Gavialidium* SERV.

(Keine Scheitelhörnchen; Hinterschienen distalwärts stark, hintere Metatarsen sehr stark und lamellenartig verbreitert. Manche Arten von *Scelimena* SERV.).

9. Pronotum stark verlängert, Seitenlappen stark gedornt, Stirnkiele in Profilansicht vor den Augen leicht concav oder nicht vor die Augen hervor tretend. Scheitel breiter als ein Auge; grosse Arten .... *Criotettix* STÅL.
N.B. Diese Definition und die nach den hier genannten Merkmalen vorgenommene Abtrennung der anschliessend genannten Gattung *Loxilobus* HC. gilt nur fürtropisch-asiatische Formen; das Genus *Loxilobus* ist von HANCOCK ganz uneinheitlich aufgefasst und nach keiner Seite hin deutlich abzugrenzen.
— Seitenlappen stark gedornt und Pronotum verlängert, dann aber Stirnkiele in Profilansicht gerundet vor die Augen hervor tretend; oder auch mit nur spitzwinklig nach aussen gewendeten, nicht eigentlich gedornten Seitenlappen, sonst wie vorher; oder auch mit verkürztem Pronotum und nur winklig nach aussen gewendeten Hinterecken des Pronotumseitenlappens, dann können die Stirnkiele in Seitenansicht vor den Augen leicht concav sein (*L. insidiosus* BOL.); Scheitel wenig schmäler als ein Auge, mittelgrosse bis kleine Arten .... *Loxilobus* HANC.
(Vgl. auch *Thoradonta* HC. 1908, in Indien und Insulinde häufig!).
10. Breite und sehr gedrungene Formen, meist mit nicht oder kaum über Abdominalende verlängertem Pronotum, das hinten spitz oder ausgeschnitten sein kann, oft ohne Flügel. Meist mit als die Augen breiterem Scheitel; dieser oft mit nach vorn nicht scharf begrenzten Grübchen und einheitlich gerundet in die Stirnkiele übergehend, nicht eckig vor die Augen vorspringend. Kopf mit Augen nie exseriert. Pronotum oft stark dachförmig mit nur wenig ausgeprägten Schultern, und besonders bei kleinen Formen (6 - 8 mm) in Profilansicht zum Teil bogig verlaufendem Mittelkiel .... 11.
— Schmal gestreckte Arten, oder kräftigere mit stets deutlich verlängertem Pronotum, nie mit im ganzen vorderen Pronotum einheitlich stark comprimiertem, bogig verlaufenden Mittelkiel (Ausnahme: *Mazarredia gallinacea* BOL. von den Philippinen), fast stets geflügelt .... 13.
11. Pronotum ohne alle erkennbaren Seitenkiele (auch der Prozona), mit fast verloschenem Mittelkiel, nicht über das Hinterschenkelende verlängert; hinten stumpf abgerundet, hinter den auf keine Weise angedeuteten Schultern blasig oder kugelig hoch aufgetrieben; Scheitel nicht vor-, aber mit ganz niedrigen Seitenhöckern über die Augen erhöht. Gänzlich aberrante Form .... *Bullaetettix* nov.
— Pronotum stets mit ausgeprägten Mittel- oder Seitenkielen, (die der Prozona können undeutlich sein), nie blasig aufgetrieben; Schultern stumpf, oder bei Arten mit, in Seitenansicht, zumindest im vorderen Pronotumteil bogig verlaufendem Mittelkiel, überhaupt undeutlich; nur die mit über das Hinterschenkelende reichendem Pronotum versehenen Formen meist geflügelt .... 12.
12. Pronotum kurz, am Ende stumpf abgerundet oder zugespitzt, ohne Flügel oder bei über die Hinterschenkelenden verlängertem Pronotum oft geflügelt; Pronotum, von der Seite gesehen, entweder durchgängig ± flach, nicht dachförmig, nicht mit bogig oder sonstwie erhobenem Mittelkiel, oder mit zumindest im vorderen Teil gleichmässig stark bogig verlaufendem Mit-

telkiel und dann stark dachförmig (vergl. auch *Apterotettix* Hc., ferner *Coptotettix* Bol. und *Acrydium* Geoffr., beide mit nicht oder kaum am Ende nach aussen gewendeten Pronotumseitenlappen, *Acrydium* mit im Profil ein wenig eckig vor die Augen vorspringenden Scheitel; schliesslich *Hydrotetrix* Uvar., kleine schmächtige Arten aus Oceanien).

Hyboella Hanc.

— Pronotum stets kurz, nicht über das Abdominalende ragend oder kürzer, am Ende ausgeschnitten, kaum dachförmig mit deutlichen Unebenheiten, Höckern etc., neben dem Mittelkiel, der in Profilansicht in mindest zwei deutlichen und starken, unregelmässigen Wellen verläuft, ohne Flügel. Breite Arten, nur von Celebes bekannt .... *Tondanotettix* Will.

13. Scheitel in Seitenansicht garnicht oder nur ganz wenig vor die Augen vortretend .... 14.

— Scheitel in Profilansicht in Form eines stumpfen Zapfens (mit concavem Abfall) von mindestens ¼ - ½ des Augendurchmessers (oder mehr) vor die Augen vortretend .... 17.

14. Pronotum sehr glatt (bis höchstens auf sehr kleine glänzende Tuberkeln, Mittelkiel, innere Schulterkiele (oder nach vorn verlängerte Seitenkiele des Pronotumfortsatzes) und abgekürzte halbseitliche Kiele zwischen den Schultern fast nur in Form von glatten Linien, niemals als deutlich erhabene Leisten, Kiele oder Runzeln ausgeprägt; Pronotum der Länge und Quere nach zwischen den Schultern einheitlich flach gewölbt; Flügel das Pronotum nicht oder kaum (um höchstens 0,8 - 1 mm) überragend; Kopf oft leicht exseriert mit relativ grossen, seitwärts stark heraus stehenden Augen; Stirnkiele in Seitenansicht oft gerundet vor die Augen vortretend (oder garnicht); Scheitel nicht breiter als höchtens ¾ eines Auges, meist nach vorn verjüngt; Pronotumseitenlappen am Ende nur stumpfwinklig ein wenig nach aussen gewendet, oder garnicht, breit und stumpf oder scharf abgeschnitten; Antennen inserieren zwischen den Augen, mindestens zwischen den unteren Augenrändern; lange, schmal, elegant und schnittig wirkende Tiere .... *Pseudoparatettix* nov.

N.B. Die Angehörigen dieser neuen Gattung ähneln den *Paratettix*-Arten, es gibt ihrer eine ganze Anzahl noch unbeschriebener, und sie sind durch ihren characteristischen gestreckten und glatten Habitus bei einiger Erfahrung und Bekanntschaft mit umfangreichen Acrydiinenmaterialien leicht von allen anderen Acrydiinae zu unterscheiden. Dennoch ist die befriedigende Characterisierung ausserordentlich schwierig, und die richtige Zuteilung der Arten wird auch nach dem hier gegebenen Schlüssel nicht wohl ohne weiteres möglich sein. Diese Schwierigkeit der Gattungsdiagnose erhellt schon daraus, dass selbst Hancock sie nicht beschrieben hat, obwohl ihm 2 hierher gehörige Arten bekannt waren: *P. angulobus* Hc. und *P. lineatus* Hc.; er hat sie, eine ganz ungewöhnliche und für seine begründete Verlegenheit bezeichnende Wendung der systematischen Auffassung, bei *Paratettix* Bol. beschrieben und später (1913) zu *Criotettix* Staal gestellt. Bolivar beschrieb eine hierher gehörige Art (*P. luridus* Bol.) bei *Xistra* Bol., ich selbst eine bei *Bolotettix* Hanc. (*P. exiguus*, ? = *P. lineatus* Hc.). Ich sah die Typen aller der genannten Arten.

— Aehnlich wie vorher, aber Kopf sehr deutlich exseriert, Scheitel vorn schmäler als das 1. Antennenglied breit ist; Gestreckte schlanke Formen. *Systolederus* Bol.

(Breite plumpe Arten mit fast oder genau wie bei *Systolederus* engem Augenabstand und etwas verlängertem und stark erhöhtem Kopf, so dass die Augen nicht unmittelbar an den Pronotumvorderrand grenzen. *Prosoaltus* Hc.).

— Pronotum ± deutlich durch Höcker, unregelmässige Unebenheiten, Runzeln usw. sculpturiert, oder deutlich dachförmig, mit, wenn auch nicht immer stark, so doch deutlich als erhabene Leisten ausgeprägten Mittel- und Schulterkielen, und, wenn vorhanden, auch abgekürzten halbseitlichen Zwischenschulterkielen; kaum je Kopf und Augen exseriert oder Augen stärker seitlich heraustretend .... 15.

15. Scheitel zwischen den Augen deutlich, zuweilen beträchtlich, eingesenkt, innen neben den Augen mit beträchtlich über die Augen ragenden Scheiteldörnchen .... *Xistra* Bol., *Tegotettix* Hc. (cf. sub 8).

— Scheitel nicht auffällig zwischen den Augen eingesenkt, Scheitelhörnchen fehlen oder sie überragen, von der Seite gesehen, die Augen nur eben wahrnehmbar als stumpfe Höcker .... 16.

16. Stirnkiele in Seitenansicht nicht einheitlich gerundet vor die Augen vortretend; Pronotum immer mit wenigstens einigen als deutlich erhabene Leisten ausgeprägten Kielen, entweder, bei plumpen, relativ breiten Formen mit meist verlängertem, mitunter aber auch abgekürztem Pronotum, ziemlich stark sculpturiert, oder, meist bei schmaleren und gestreckteren Formen, mit ausser den Kielen glatterem Pronotum und häufiger ± deutlich exseriertem Kopfe; Pronotum fast stets hinter der Schulterregion, oft zwar ziemlich flach, ein wenig grubig eingesenkt; Scheitel fast nie schmäler als ein Auge .... *Mazarredia* Bol.

N.B. Die artenreiche Gattung *Mazarredia* ist sehr uneinheitlich zusammen gesetzt und fast nur negativ zu characterisieren. Deutlich zusammengehörige Gruppen bilden die Arten um *M. sculpta* Bol., dann die um *M. ophthalmica* Bol. (z.T. augenscheinlich bei *Bolotettix* Hc. beschrieben); sehr isoliert stehen *M. semperi* Bol., *M. fuscipes* Staal (= *M. lauta* Bol.) u. a., zu *Prosoaltus* Hanc. leitet über *M. rufipes* Staal. Nach keiner Richtung ist *Mazarredia* Bol. sicher abzugrenzen.

(*Eugavialidium* sehr ähnlich, ♀♀ mit verdickten 3. Gliedern des Hintertarsus *Falconius* Bol.).

— Aehnlich wie *Mazarredia,* Kopf nie exseriert, Stirnkiele in Seitenansicht meist gerundet vor die Augen tretend, zuweilen (*L. insidiosus* Bol., mit abgekürztem Pronotum) auch leicht concav; Antennen zwischen den unteren Augenrändern, nie deutlich weit unter den Augen, einlenkend. *Loxilobus* Hanc.

(Vgl. auch *Thoradonta* Hanc. 1908, in Indien und Insulinde häufig! Stirnkiele in Seitenansicht ganz gleichmässig gerundet bis zu der Fühlereinlenkungsstelle hin zwischen den Augen hervor tretend, Fühler weit unterhalb der Augen eingelenkt, Kopf nie exseriert, Borneo ... *Orthotettix* Hanc.).

17. Scheitel, von der Seite gesehen, nach vorn in eine stumpfen Zapfen ausgezogen, der höchstens ½, und mindestens ¼ so lang wie ein Auge breit ist, Abfall zu den unter den Augen inserierenden Antennen concav. Scheitel mit Mittelkiel, Zapfen, von oben gesehen, ohne Seitenhöcker, Augen an den Pronotumvorderrand angrenzend; Pronotumkiele deutlich, leistenartig. *Spadotettix* HANC.

— Scheitel nach vorn in einen Zapfen verlängert, der in Seitenansicht länger als ein Auge breit ist, oben gekielt und mit Höckern an den Seitenkanten; Antennen zwischen den unteren Augenrändern inseriert; Augen grenzen an den vorderen Pronotumrand (vgl. auch *Mitrariella* HEB. nom. praeocc.). *Rostella* HC.

(Antennen zwischen den Augenunterrändern inseriert oder tiefer.

a Augen um die Hälfte ihres Durchmessers vom Pronotumvorderrand entfernt, Scheitelzapfen oben concav ohne Kiel, und ohne Seitenrandhöcker; 3. Hintertarsenglieder der ♀♀ verdickt (cf. *Paramitraria* WILL.). *Rhopalotettix* HC.

b Augen um fast doppelte Breite vom Pronotumvorderrand entfernt; Stirnzapfen mit stumpfem Mittelkiel, ohne Seitenkantenhöcker, nicht länger als Augendurchmesser. Nur Südmelanesien .... *Thyrsus* BOL.

Antennen über den Augen inseriert, Philippinen .... *Cleostratus* STAAL).

18. Scheitel vorn schmäler als das 1. Antennenglied breit ist, Augen oft sehr gross, Kopf ± deutlich exseriert .... *Systolederus* BOL.

(Kopf nicht exseriert, Augen überragen nicht das Pronotum nach oben. *Teredorus* HANC.).

— Scheitel auch vorn stets breiter als das 1. Antennenglied .... 19.

19. Scheitel, in Seitenansicht, ein wenig über die Augen erhöht und nach vorn eckig vor die Augen vorspringend (doch nicht etwa in Form eines Zapfens, der auch nur ¼ der Augenbreite an Länge erreichen würde), von oben gesehen, meist breiter als ein Auge; Stirnkiele in Seitenansicht vor die Augen vortretend, aber nicht gerundet; Fühler mit sehr kurzen, relativ dicken Gliedern unter den Augen eingelenkt; 3. Hintertarsenglied kürzer als der hintere Metatarsus; Pronotum sehr oft verkürzt. *Acrydium* GEOFFR.

— Scheitel in Seitenansicht nicht deutlich vor die Augen vorspringend, wohl aber häufig die Stirnkiele, die meist gerundet, seltener concav oberhalb der Augen erscheinen; sie verlaufen meist unmerklich in den Scheitel oder stossen seltener unter einem oft undeutlichen und stumpfen Winkel, der in genauer Profilansicht sichtbar ist, mit dem Scheitel zusammen; bei Arten mit unverkürztem Pronotum überragen fast stets die Alae deutlich das Pronotumende, um 1,5 - 3, selbst 5 mm .... 20.

20. Scheitel, von oben gesehen, nach vorn deutlich verbreitert, in Profilansicht häufig ein wenig vor und auch über die Augen tretend; Stirnkiele in Seitenansicht vor die Augen tretend, gerundet oder leicht concav, zuweilen unter einem ± undeutlichen stumpfen Winkel mit dem Scheitel zusammen stossend. Antennen zwischen den unteren Augenrändern oder höher eingelenkt,

Augen oft leicht erhoben; Pronotummittelkiel, von der Seite gesehen, fast stets ± deutlich bogig verlaufend .... *Hedotettix* BOL.

— Scheitel, von oben gesehen, nach vorn gleichmässig breit oder verschmälert, Fühler nicht höher als zwischen den unteren Augenrändern eingelenkt; Pronotummittelkiel in Seitenansicht nie deutlich gleichmässig bogig verlaufend (ausser im vorderen Pronotumteil bei sehr kleinen — 7 - 9 mm — Arten von *Coptotettix* BOL.) .... 21.

21. Scheitel, von oben gesehen, nach vorn deutlich verschmälert, oder kleine Arten (5 - 9 mm) mit verkürztem stark dachförmigen Pronotum, dessen Mittelkiel im vorderen Teil stark bogenförmig verläuft, fast nie mit irgendwie erhobenem Kopfe, Pronotum oft mit ± schwachen Längsrunzeln. *Coptotettix* BOL.

N.B. Bei Formen ohne Runzeln auf dem Pronotum ist auch *Pseudoparatettix* n.g. zu vergleichen; zu *Coptotettix* gehörende Arten ohne Runzeln sind, ausser *C. interruptus* BOL., viel kleiner als die Species von *Pseudoparatettix*, höchstens bis 12 mm lang.

— Scheitel nach vorn weder verschmälert noch verbreitert, nie über die Augen nach oben tretend (in Seitenansicht); Kopf fast stets ± leicht oder deutlich erhoben, Pronotum nie mit unregelmässigen Längsrunzeln .... 22.

22. Kopf nicht beträchtlich exseriert, Stirnkiele in Seitenansicht fast stets vor die Augen tretend, gerundet oder concav .... *Paratettix* BOL.

N.B. Vergl. *Pseudoparatettix* n.g. (14); die dahin gehörenden Arten sind glatter als die *Paratettix*-Arten, mit zwischen den Schultern ganz gleichmässig längs und quer schwach gewölbtem Pronotum ohne wahrnehmbare flache Grübchen hinter der Schulterregion beiderseits vom Mittelkiel, mit in Seitenansicht nicht irgendwie wellig zwischen den Schultern verlaufendem Pronotummittelkiel, und mit das Pronotum nicht oder kaum (höchstens um 0,8 mm) überragenden Alae.

— Kopf sehr deutlich und stark exseriert, Augen überragen die Pronotumfläche beträchtlich nach oben .... 23.

23. Stirnkiele in Profilansicht deutlich flach gerundet, von oben an vor die Augen vortretend .... *Euparatettix* HANC.

— Stirnkiele in Seitenansicht erst zwischen der Mitte oder den unteren Hälften der Augen vor diese vortretend, Pronotummittellinie in Seitenansicht fast immer gewellt verlaufend .... *Indatettix* HANC.

Kraengia apicalis BOL. 1909. Fig. 4, 5.

6 Exemplare, Südcelebes: Lompo Batang, 1000 m, III.1896, und Boea Kraëng, 1250 m, II.1896, FRUHSTORFER leg.; 5 in Naturkunde-Mus. Stettin, 1 in Mus. f. Tierkde, Dresden.

Diese einzige Art der Gattung, von BOLIVAR in die Sectio der Tripetalocerae gestellt, steht diesen ebenso fern, wie den bei der Sectio Discotettigiae vereinigten Gattungen, vermöge der singulären Bauart ihrer Antennen. Im übrigen ähnelt *Kraengia apicalis* sehr dem *Tondanotettix gibbosus* DE HAAN oder *Cladonotella interrupta* BOL. und kann sicher wohl nur bei erhaltenen Antennen erkannt werden.

Ophiotettix cygnicollis WLKR. 1871.

Diese Art ist ausser von WESTWOOD für Celebes nirgends erwähnt, auch C. BOLIVAR Y PIELTAIN lagen sie für seine Monographie der Gattung ebenso wenig wie mir vor. Dennoch braucht diese Fundortangabe nicht auf Irrtum zu beruhen, denn das Vorkommen in Menado und zumindest westlichen Neu Guinea ist auch z.B. bei Phasmoiden-Arten bekannt.

Das Genus **Hirrius** BOL. 1887.

Hirrius BOL. wurde für die Art *punctatus* STAAL 1877 (Philippinen) errichtet, die mir in zwei Exemplaren aus dem Museum Hamburg vorliegt; weitere Arten der Gattung sind bisher nicht bekannt geworden. *Hirrius punctatus* STAAL ist ausgezeichnet durch Verbreiterung der Antennenglieder, von denen das 9. und besonders 10. auffällig verbreitert und ± blattförmig sind, durch das glatte, nicht über das Abdominalende verlängerte Pronotum, an dem die Seitenkanten und die Carina humero-apicalis (nach HANCOCK) und auch der Mittelkiel sehr undeutlich ausgeprägt sind; die Art besitzt keine Flugorgane und zeigt die Hinterecken der Seitenlappen ein wenig nach aussen gebogen. Sie ähnelt äusserlich der Gattung *Phaestus* BOL. 1887, ohne aber zu ihr, die einige Besonderheiten besonders in der Bildung des stark verkürzten Scheitels aufweist, in näherer Verwandtschaft zu stehen; sicher aber steht *Hirrius* der Gattung *Discotettix* COSTA einiger Maassen nahe.

Nun liegen von Celebes 3 Arten vor, die mit dem *Hirrius punctatus* verwandt erscheinen, zum Teil aber Anklänge an *Discotettix* COSTA zeigen; sie werden im folgenden als zur Gattung *Hirrius* gehörig beschrieben. Die eine von ihnen, *H. scrobiculatus* n.sp., stimmt mit *H. punctatus* am ehesten überein: auch sie zeigt eine nur schwache Ausprägung der Pronotumkiele und eine ganz ähnliche Bildung der Antennen, deren Glieder seitlich wie bei *H. punctatus* nicht gezähnelt sind; doch hat *H. scrobiculatus* eine sehr deutliche Carina humero-apicalis und Flugorgane. Die beiden anderen Arten, *H. sarasinorum* n.sp. und *H. montanus* n.sp., stehen einander recht nahe und sind vielleicht nur Localrassen einer Art; sie haben sehr deutliche, aber stumpfe Mittel- und Seitenkiele des unbewehrten Pronotums und, wie *Discotettix*, seitlich gezähnelte Antennenglieder; die Carina humero-apicalis ist fast erloschen, Flugorgane sind vorhanden. Für sie hätte auch eine neue Gattung errichtet werden können, doch stehen sie offenbar dem *Hirrius scrobiculatus* nahe genug, um mit ihm in einer Gattung vereinigt zu werden.

Hirrius sarasinorum nov. spec. Fig. 1, 6.

1 ♀, "Celebes", Dres. SARASIN legrnt., Mus. Basel (Paratypus); 1 ♀, Nordcelebes, Toli Toli, XI.XII.1895, FRUHSTORFER leg., Mus. Stettin (Paratypus); 4 ♂♂, 1 ♀, Nordcelebes, Ile Ile, 500 m, XI.XII.1930, G. HEINRICH leg., Mus. Berlin Holo-, Allo- und Paratypen (Mus. Dresden); ferner 1 ♂, Loka, Piek van Bonthain, X.1895, Drs. SARASIN legrnt., Mus. Basel.

Graubraun oder hellbraun, Pronotumkiele heller, Seiten dunkler. Antennen schwarz, 5. - 10. Glied gestreckt, an den Seiten bedornt, die letzten vier Glieder zusammen nicht länger als das vorhergehende verbreiterte 10. Mittel- und Seitenkiele des Pronotums deutlich erhoben. Pronotumoberfläche der Länge nach jederseits vom Mittelkiel concav, bei den von SARASIN gesammelten Tieren undeutlich körnelig, bei den anderen sehr grob punktiert (oder "genetzt", reticulatus), sonst ohne umfangreichere und deutliche grubige Einsenkungen oder Höcker, bis kurz vor die Mitte der Schienen nach hinten reichend. Pronotumseitenlappen und die vier Vorderschenkel gekörnelt, diese mit comprimierter rauher Ober- und Unterkante und undeutlichen wenigen Zähnen. Hinterschenkel unten der Länge nach fast schwarz. Hintertarsen lang, 3. Glied so lang wie 1., dessen Pulvillen stumpf, der dritte sehr viel länger, als jeder der beiden vorderen. Long. tot. ♂ 11,5 - 16 mm, ♀ 16 - 17 mm.

Das ♂ vom Piek van Bonthain (Mus. Basel) ist nicht als Paratypus bezeichnet, ihm fehlen die Antennen, und es ist möglich, dass es bei deren Kenntnis einer anderen Art zugewiesen werden müsste.

Hirrius scrobiculatus n.sp. Fig. 2, 8.

1 ♂ 1 ♀, Nordcelebes, Ile Ile, 500 m, XI.XII.1930, G. HEINRICH leg., Holo- und Allotypus, Mus. Berlin und Dresden.

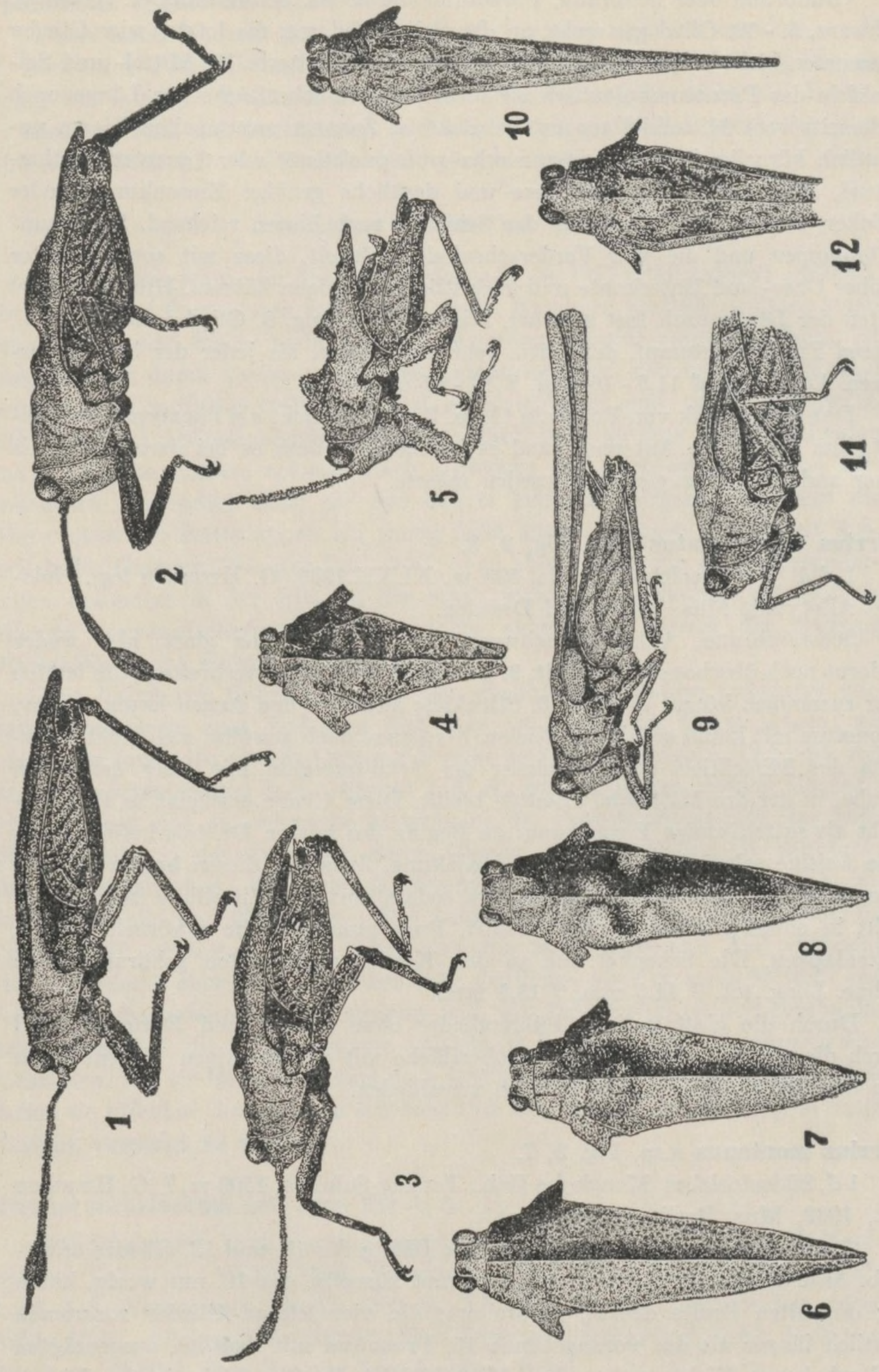
Schwarzbraun, Antennen schwarz, ihre Glieder ganz glatt, also weder gedornt noch überhaupt gekörnelt, 9. wenig, 10. sehr stark verbreitert, die letzten vier zusammen kürzer als das 10. Stirnkiele zwischen den Augen kaum concav. Pronotum mit kaum erhabenen Kielen, der Quere nach gewölbt, also nicht jederseits des Mittelkiels concav; hinter der Schulterregion mit einer deutlichen Grube, in der der Mittelkiel erhalten bleibt. Diese Grube erscheint in Profilansicht als sattelförmige Einsenkung; zu Beginn des letzten Drittels befindet sich eine weitere schwächere derartige Einsenkung. Zwischen diesen beiden Einsenkungen ist die Pronotumfläche gewölbt, sodass dort die Mittellinie in Profilansicht in einem flachen Bogen verläuft. Pronotumoberfläche gekörnelt, ebenso Seitenlappen. Die Schenkel nur an den Kanten und Leisten gekörnelt, ohne Zähne. Long. tot. ♂ 11,5 mm, ♀ 13,5 mm.

Durch die glattrandigen Fühlerglieder ohne Körner und Dörnchen, und durch die unregelmässige Pronotumoberfläche mit grubenartigen Einsenkungen von der vorhergehenden Art deutlich verschieden.

Hirrius montanus n.sp. Fig. 3, 7.

1 ♂, Südostcelebes, Mengkoka Geb., Tangke-Salokko, 1500 m, I. G. HEINRICH leg., 1932, Mus. Berlin (Holotypus).

Grau, Antennen schwarz, aber distale Hälfte des 11. und 12. Gliedes ockergelb. Antennenglieder schwach und zerstreut körnelig, das 10. nur wenig, kaum zur doppelten Breite des 8., verbreitert; die vier letzten Glieder zusammen deutlich länger als das vorangehende 10. Pronotum mit deutlich ausgeprägten und erhabenen Kielen, neben dem Mittelkiel ist die Oberfläche in der Längs-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richtung schwach concav. In der Schulterregion jederseits neben dem Mittelkiel ein deutlicher kleiner Höcker (= abgekürzte halbseitliche Zwischenkiele, wie sie vielen Acrydiinen-Arten zukommen), hinter den Schultern jederseits vom Mittelkiel eine undeutliche flache Einsenkung; kurz vor der Mitte des Pronotumfortsatzes geht von den Seitenkielen schräg nach vorn ein undeutlich erhabene Runzel ab, die aber nur bis zur Mitte der Entfernung des Seiten- vom Mittelkiel reicht. Mittelkiel von der Seite gesehen mit zwei welligen niedrigen Erhebungen kurz hinter einander in der Schulterregion. Schenkel deutlich gekörnelt. Die vier vorderen mit comprimierten, welligen Rändern, die vier vorderen Schienen mit je einem ockergelben Ring. Die proximalen zwei Dritteile der Krallenglieder und das 1. Hintertarsenglied ockergelb, von dessen 3 Pulvillen ist der letzte sehr viel länger und grösser als jeder der beiden anderen. Long. tot. ♂ 13 mm.

Durch die, wenn auch schwach gekörnelten Fühlerglieder und die jederseits vom Mittelkiel concave Pronotumoberfläche ohne tiefere und auffällige grubige Einsenkungen von *H. scrobiculatus* verschieden und *H. sarasinorum* nahestehend; von dieser Art ist *H. montanus* durch den in Profilansicht unregelmässigen Verlauf des Pronotummittelkiels, durch die als deutliche Höcker erhobenen abgekürzten Schulterzwischenkiele, besonders aber dadurch unterschieden, dass die vier letzten Fühlerglieder länger als das vorhergehende 10. sind, während sie bei *H. sarasinorum* deutlich kürzer als das 10. sind. Es ist aber möglich, dass *H. montanus* später bei Kenntnis von mehr Material nur als Lokalform des *H. sarasinorum* angesehen werden kann.

Criotettix bispinosus DALM. 1818. Fig. 9 - 12.

1 ♀, Südostcelebes, Towoeti-See, Drs. SARASIN legrnt., Mus. Basel; 2 ♂♂, 3 ♀♀, Südwestcelebes, Makassar, Cpt. CONRAD leg., Mus. Berlin.

Diese Art variiert nach den Standorten, offenbar aber auch nach anderen Abhängigkeiten, beträchtlich; schon früher (Revue Suisse Zool.) habe ich *C. saginatus* BOL. als synonym zu *C. bispinosus* gezogen (es kann sich auch bei ihm um eine Localrasse handeln). Auch *C. miliarius*, dessen Typus ich sah, lässt sich nicht anders als die Ceylonrasse des *C. bispinosus* auffassen [1]).

Von all den Formen des *C. bispinosus*, der mir also von Ceylon über Insulinde bis zu den Philippinen und Südchina bekannt ist, ist die hier von Celebes erwähnte eine der auffälligsten. Diese Tiere sind durch kleinere Statur, ferner durch weniger stark als bei den meisten anderen Formen des *C. bispinosus* ausgeprägte Pronotumseitenlappendornen, aber schärfer ausgeprägte Pronotumrunzeln geschieden. Durch die beiden letztgenannten Umstände nähert sich die

[1]) Weiterhin nur als Subspecies zu *C. bispinosus* dürfte *C. latifrons* HEBARD 1929 anzusehen sein (Südindien), der nach HEBARD zusammen mit *C. miliarius* BOL. durch breiteren Scheitel von *C. saginatus* BOL. verschieden sein soll. Der Typus des *C. miliarius*, den ich sah, ist jedenfalls von zahlreich aus der Coll. WILLEMSE mir bekannten Exemplaren des *C. saginatus* (Ft. de Kock, Sumatra) ganz sicher nicht durch breiteren Scheitel unterschieden, und es ist anzunehmen, dass auch zwischen *C. saginatus* und *C. latifrons* jenes von HEBARD angegebene Unterscheidungsmerkmal in Wirklichkeit nicht besteht.

Form dem *C. longinotus* HANC. 1907 von Nordborneo, dessen Typus ich sah; auch diese Form ist für eine Rasse des *C. bispinosus* zu halten. Von den Tieren mit der Fundortangabe Macassar ist wiederum das ♀ vom Towoeti-See ein wenig unterschieden; es ist noch etwas kleiner und besonders durch die starken Runzeln um die Einsenkungen des Pronotums hinter den Schultern ausgezeichnet. Auch bei ihm verläuft der Mittelkiel wellig, doch ist (? normal) der Pronotumrücken so stark eingesenkt, dass die Wellen des Mittelkieles in genauer Seitenansicht nicht erscheinen. Die Masse betragen: Long. tot. ♂ 16, ♀ 17,5 - 19,5 mm.

Ich bin überzeugt, dass es sich hier um die gleiche Art handelt, wie sie WILLEMSE in „Orthoptera Sarasiniana" (Treubia XII Suppl., 1931, p. 197) als *nexuosus* BOL. für Celebes, auch von Makassar, anführt. Diese sehr robuste und breite, *C. nexuosus* BOL., deren Typus (Mus. Wien) ich gesehen habe, ist mir nur durch ihn und von Borneo bekannt; dieser Typus stammt von Ost- oder Südost-Borneo, da er von GRABOWSKI gesammelt ist, der nirgends anders war.

Eugavialidium celebicum BOL. 1887.

4 ♂♂, 1 ♀, Nordcelebes, Matinan-Geb., 600 m, X. 1930, 1 ♀, Celebes, Latimodjong-Geb., Oeroe, 800 m, VIII. 1930, G. HEINRICH leg., Mus. Berlin; 1 ♂, Nordcelebes, Toli Toli, XI. XII. 1895, 1 ♂ 3 ♀♀, Südcelebes, Samanga, Patoenoeang, Boea Kraëng, XI. 1895, I. II. 1896, FRUHSTORFER leg., Mus. Stettin; 1 ♂ 1 ♀, Patoenoeang, FRUHSTORFER leg., Mus. Hamburg; 1 ♂, „Celebes", A. B. MEYER leg. 1871, Mus. Dresden.

Die Tiere von Nordcelebes entsprechen der Beschreibung und Massangabe BOLIVARS gut; die von Südcelebes sind grösser (long pron. ♂ 22, ♀ 25 - 27 mm) und haben an den 4 vorderen Schenkeln ausser dem deutlichen Basalzahn oben noch weitere kleine Zähne, die 4 Vorderschienen sind gelb geringelt. Sie stellen aber sicher nur die südliche Lokalform dar, und so wird die ganze Art dem *Eugavialidium aurivillii* BOL. genähert, von dem sie vielleicht gar nicht verschieden ist.

Genus **Tegotettix** HANC.

1913 HANCOCK, Sarawak Mus. Journ., I, 3, p. 48.
1935 GÜNTHER, Arb. morph. tax. Ent. Brln.-Dahlem, II, p. 261.

Die einzige bei dieser Gattung beschriebene Art, *armatus* HANC. 1913, erkannte ich l.c. für generisch übereinstimmend mit einer Art, die ich für *Xistra corniculata* STÅL hielt; also zog ich *Tegotettix* zu *Xistra* BOL. als Synonym. Inzwischen sah ich den Typus von *Xistra corniculata* STÅL (Mus. Stockholm); mit ihm stimmen die Tiere, die ich l.c. als diese Art bezeichnete zwar augenscheinlich nicht spezifisch, aber doch generisch überein. Andererseits sah ich *Xistra gogorzae* BOL. (Mus. Berlin), diese Art ist nach KIRBY 1910 die Genustype von *Xistra* BOL., sie weicht generisch von allen anderen Arten, die BOLIVAR zu *Xistra* stellte, ab. Daher müssen die generisch übereinstimmenden Arten *Xistra corniculata* STÅL, *Xistra cristifera* K. GTHR aus dem Genus *Xistra* BOL.

entfernt werden [1]). Als das ratsamste will erscheinen, die Gattung *Tegotettix* HANC. wieder herzustellen, doch ergeben sich hier die für die Acrydiinensystematik überhaupt so charakteristischen Schwierigkeiten: *Tegotettix armatus* HANC. ist gattungsverwandt oder gar spezifisch identisch mit *Gavialidium tuberculatum* BOL., das aber nicht zu *Gavialidium* SERV. gehört, immerhin, wären nicht die anderen oben erwähnten Arten zu berücksichtigen, könnte man unschwer *Tegotettix* HANC. auch zu *Gavialidium* SERV. (HANC. 1906) ziehen. Doch die generisch verwandte 1935 von mir als ? *Xistra corniculata* STÅL bezeichnete Art, die auf Celebes in einer sehr grossen Form auftritt, liegt von Borneo und Neu Guinea in kleineren von *tuberculatus* (*armatus*) schon recht abweichenden Formen vor, an die sich die noch kleinere echte *X. corniculata* STÅL von den Philippinen anschliesst, die mit den *Gavialidium*-Arten keine Aehnlichkeit mehr hat. Kennte man nur diese Art allein, würde ihre generische Trennung von *X. gogorzae* BOL. nicht als vordringlich erscheinen.

Man kann nun *Tegotettix* bestehen lassen, und die Arten ?*Xistra corniculata* STÅL? GTHR. 1935, *Xistra corniculata* STÅL und *X. cristifera* GTHR. hinein nehmen, dann erscheint *Tegotettix* äusserlich uneinheitlich und wegen der Affinität des *armatus* zu den *Gavialidium*-Arten nicht sicher begrenzt. Oder man kann *Tegotettix armatus* HANC. zu *Gavialidium* SERV. ziehen, und für die übrigen genannten von *Xistra* BOL. übernommenen Arten eine neue Gattung schaffen, dann ist zwar diese einheitlich, aber die Gattung *Gavialidium* SERV. wäre dann uneinheitlich und wegen der Affinität des *armatus* HC. zu der Celebesform der neu zu creïerenden Gattung von dieser schwer abzugrenzen; schliesslich könnte man *Gavialidium* einheitlich lassen, wie es seit HANC. 1906 ist, könnte *Tegotettix* HANC. bestehen lassen, und für die übrigen Arten eine neue Gattung errichten: dan hätte man zwar 3 einheitliche Gattungen, die aber gegeneinander überhaupt nicht sicher abzugrenzen wären. In nuce bietet also dieser Fall der Gattung *Tegotettix* HANC. ein hinlänglich anschauliches, Bild von der Schwierigkeit der Acrydiinensystematik.

Hier wird also die Gattung *Tegotettix* HANC. mit den Arten *armatus* HANC., *tuberculatus* BOL., *siebersi* nov. spec., *corniculatus* STÅL, *stylatu* HANC., *cristifera* GTHR. beibehalten. Die Diagnose HANC. muss in einigem modificiert werden: der Pronotummittelkiel trägt nicht bei allen Arten ausser der Crista zwischen den Schultern eine Serie von grossen Höckern oder Hörnern, und das 3. Hintertarsenglied ist deutlich kürzer als das 1.; hier erscheint HANCOCKS Angabe irrig.

Tegotettix armatus HANC. Fig. 13, 15.

1913 HANCOCK, Sarawak Mus. Journ., T. 3, p. 48.

1935 GÜNTHER, Arb. morph. taxon. Ent. Brln.-Dahlem, II, p. 261 (*Xistra*).

1 ♀, NW.Celebes: Paloe-Tal, 1895 Dres. SARASIN legrnt., Mus. Basel.

[1]) Von den übrigen von BOLIVAR zu *Xistra* gestellten Arten gehören *sagittaria* BOL. und *impressa* BOL. zu *Mazzaredia*; *lurida* BOL., und vielleicht auch, als recht aberrante Art, *ochracea* BOL. zu *Pseudoparatettix* HANC., *similis* BOL. zu *Paratettix*; ich habe diese Typen aller dieser Arten (Mus. Stockholm) gesehen.

Dieses Exemplar stimmt nicht völlig mit dem überein, das mir aus der Ausbeute von H. C. SIEBERS aus dem mittleren Ostborneo bekannt geworden ist. Seine Farbe ist grau, mit helleren Ringen um die 4 Vorderschienen und Querbinden an den Hinterschenkeln, ferner sind die Antennen eng hell geringelt und die Schenkelzähne heller gefärbt. Die Höcker des Pronotums sind am oberen Rande viel deutlicher gezähnelt oder crenuliert als bei dem Tiere von Borneo; der grosse Höcker zwischen den Schultern und der erste ihm folgende des Pronotumfortsatzes sind bei dem hier vorliegenden Tiere mehr crista-förmig, in Profilansicht oben gerundet, und während bei dem ♀ von Borneo auf den 1. Höcker des Pronotumfortsatzes noch 4 an Grösse ständig abnehmende folgen, sind es bei dem von Celebes nur 2 ziemlich kleine Höcker. Auch das Celebestier hat die dornenähnlichen Höcker auf der Aussenfläche der Hinterschenkel in deren distaler Hälfte.

Da das von Borneo mir bekannt gewordene Exemplar nicht völlig der Beschreibung HANCOCKS (nach einem ♂ von Kuching, Sarawak) entspricht, die immerhin eher auf das ♀ von Celebes passen würde, so nehme ich die Variabilität der Art als gross an und stelle beide mir bekannten Exemplare, je 1 ♀ von Borneo und Celebes, zu ihr.

Gavialidium tuberculatum BOL. 1887 (HANCOCK stellte es 1906 zu *Eugavialidium* HC.) muss eine nahe verwandte und sehr ähnliche Art sein, die von *armatus* HC. nach der Beschreibung durch engeren Scheitel, vielleicht auf der Fläche glatteres Pronotum, das aber längs der Mittellinie auch mit Höckern versehen ist, und durch Hinterschienendornen verschieden wäre. Wahrscheinlich aber ist die Beschreibung in manchem unzulänglich, anderem kein spezifischer Wert beizumessen, und es wäre dann *Tegotettix armatus* HC. synonym zu *Tegotettix tuberculatus* BOL., wenn nicht die Formen von Borneo und Celebes bei später reichlicher vorliegendem Material als verschieden sich herausstellen sollten.

Tegotettix corniculatus celebensis ssp. n. Fig. 14, 24.

1 ♀, Celebes, Latimodjong-Geb., Oeroe, 800 m, VIII.1930, G. HEINRICH leg. Mus. Berlin; 1 ♀, Südcelebes, Samanga, XI.1895, H. FRUHSTORFER leg. Mus. Stettin.

Von der Nominatform (Philippinen) durch viel bedeutendere Grösse, dem gänzlichen Mangel an Hinterschienendornen und die Länge der hinteren Metatarsalpulvillen geschieden, deren beide ersten gleich lang sind, während der dritte kürzer als jeder von beiden ist. Die Antennen des ♀ von Oeroe sind hell und eng deutlich geringelt, die des anderen fehlen. Der aufgebogene, nach aussen spitze Seitenlappen des Pronotums hat auch kurz vor seiner Spitze einige stumpfe Höcker (die der Nominatform fehlen). Long. tot. 25 und 20 mm, fem. post. 7 u. 6 mm.

Bullaetettix nov. gen.

Scheitel in Seitenansicht nicht vor die Augen vortretend, oben undeutlich bis zur Mitte der Augen gekielt, jederseits vom Kiel mit einer nach vorn durch

erhöhten Rand begrenzten Grube, seitlich mit stärker erhöhten Schuppen, die in Seitenansicht über dem Auge sichtbar sind. Stirnkiele grade abfallend, erst zwischen den deutlich unterhalb der Augen inserierten Fühlerwurzeln sehr flach (in Seitenansicht) erhöht, darunter eingekerbt, Antennen kurz, mit 14 normalen runden Gliedern, deren letztes verkürzt ist.

Pronotum mit fast erloschenen Prozonaseitenkielen, fast erloschenem, nur über den Kragenfalten etwas deutlichem Mittelkiel, mit scharfen einfachen Seitenkielen ohne Schulterandeutungen. Oberfläche grob einheitlich gekörnelt; hinter der Schulterregion hoch blasenförmig oder kugelig aufgetrieben, abgekürzt, hinten abgerundet. Keine Flugorgane. Pronotumseitenlappen am Ende stumpf und nach aussen gewendet. Die Schenkel glatt, die 4 vorderen oben deutlich gekielt. Genustype: *Bullaetettix sarasinorum* nov. spec.

Geographische Verbreitung: Celebes.

Völlig aberrant erscheinende Gattung, für die nähere Verwandte nicht anzugeben sind, sie wird am besten in die Sectio Metrodorae eingereiht.

Bullaetettix sarasinorum n. sp. Fig. 18, 19.

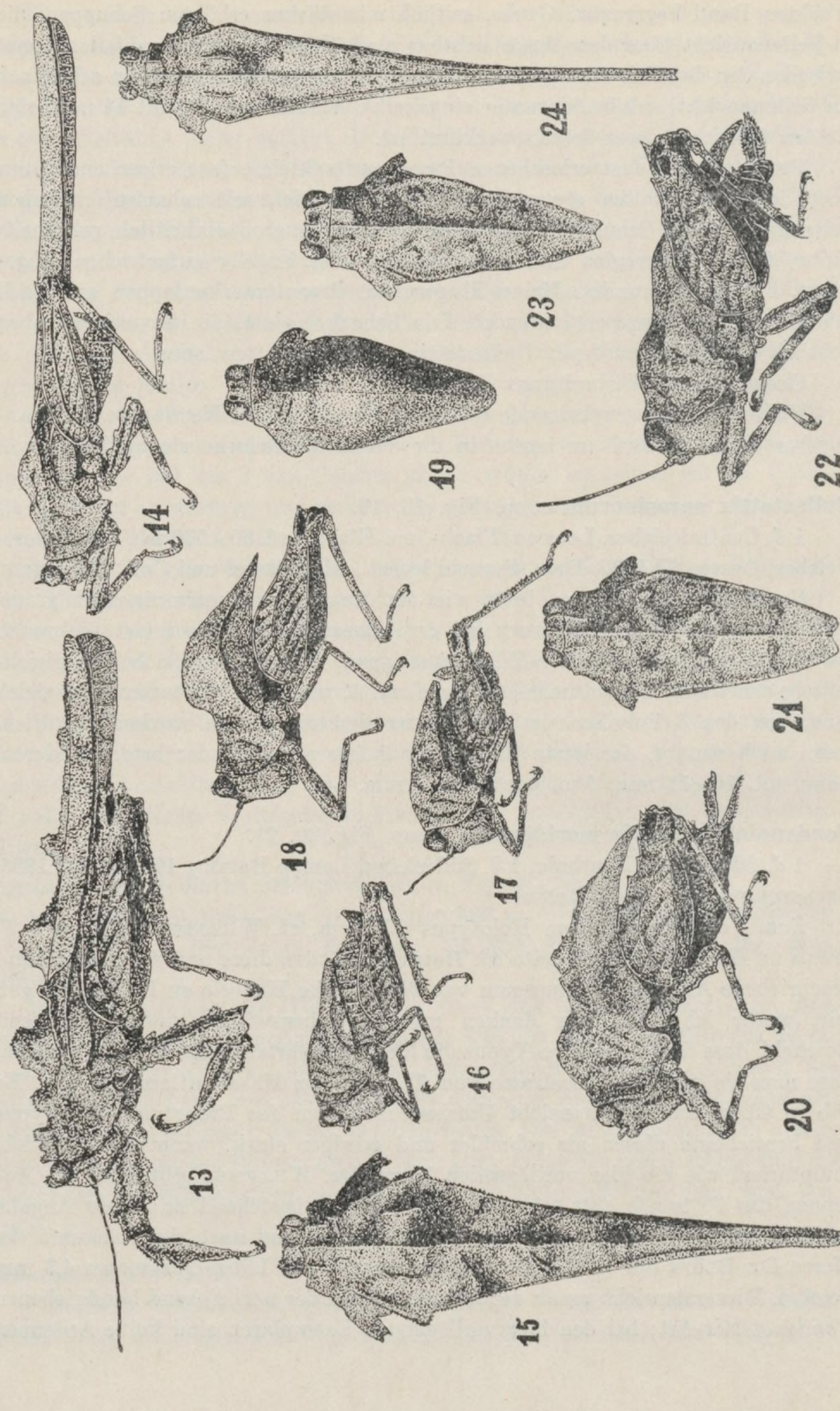
1 ♂, Centralcelebes, Loewoe (Flach- und Hügelland, 80 - 500 m), 1 ♀, Südost-Celebes, Oessoe, II.1896, Drcs. SARASIN legrnt., Mus. Basel und Coll. WILLEMSE.

Graubraun, Scheitel so breit wie ein Auge, Pronotumvorderrand grade. Auftreibung des Pronotums vorn bei dem Exemplar von Ussu fast senkrecht, bei dem von Luwu mehr allmählich ansteigend, nach hinten bei beiden gleichmässig sanft zum Pronotumende verlaufend. 1. und 3. Hintertarsenglied gleich lang, von den 3 Pulvillen des Metatarsus sind die beiden vorderen deutlich, wenn auch stumpf, der letzte flach, aber länger als jeder der beiden anderen. Long. tot. 10 - 11 mm, fem. post. 6,5 - 7 mm.

Tondanotettix brevis meridionalis n. ssp. Fig. 20, 21.

1 ♂, Südcelebes, Bonthain, 1 ♀, Südcelebes, Lompo Batang, 1000 m, III.1896, FRUHSTORFER leg., Mus. Stettin.

Zum Vergleich mit dem Holotypus (Unicum, cf. WILLEMSE 1928) von *T. brevis* DE HAAN 1842 übersandte ich Herrn Dr. BLÖTE diese und die nachstehend beschriebene Art ans Rijksmuseum van Natuurlijke Historie zu Leiden. Er gab mir, wofür ich auch hier danken möchte, liebenswürdig und erschöpfend Bescheid, dass dem gedachten Typus die hier angeführten Tiere so nahe stünden, dass man sie wohl als Localrasse von *T. brevis* DE HAAN auffassen könne. Er gab in Ober- und Seitenansicht Umrisszeichnungen des Pronotums des Typus und bezeichnete diesen als schmäler und weniger stark, wenn auch ähnlich, sculpturiert wie die hier vorliegenden Tiere. Dr. WILLEMSE gibt 1928 die Antennen des *T. brevis* s.str. als aus 8 - 9 Gliedern bestehend an; diese Angabe ist irrig, da die Antennen des Typus abgebrochen und nach der Auskunft des Herrn Dr. BLÖTE nur 10 Glieder erhalten sind, deren Länge zusammen 4,3 mm beträgt. Dies entspricht genau der Antennenlänge der nachstehend beschriebenen *Tondanotettix*-Art; bei den hier vorliegenden Exemplaren sind keine Antennen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erhalten. Die Abbildung DE HAANS entspricht dem wirklichen Aussehen des Typus von *T. brevis* DE HAAN sehr wenig, wie mir Herr Dr. BLÖTE bestätigt.

Die hier vorliegenden Tiere sind graubraun mit undeutlich geringelten Beinen. Stirnkiele treten in Seitenansicht nicht vor die Augen, sind aber zwischen den weit unter den Augen eingelenkten Fühlerwurzeln stark vorgebuchtet. Scheitel deutlich breiter als ein Auge, Kopf samt Augen nicht über das Pronotum erhoben. Pronotum mit deutlichem kräftigem Mittelkiel und deutlichen kräfgen Prozona- sowie einfachen Seitenkielen, sämtliche Kiele nicht stark erhaben. Pronotumoberfläche breit, nicht eigentlich dachförmig, sehr rauh, in Seitenansicht vor und hinter der Mitte in weitem Bogen unregelmässig erhoben, dazwischen eingesenkt. Auf der Fläche sind kräftige Höcker vorhanden, je einer befindet sich dicht neben dem Mittelkiel an seiner vorderen Aufwölbung, ferner jederseits einer in einer etwas weiteren Entfernung vom Mittelkiel zwischen den (kaum angedeuteten) Schultern, und in grösseren Abständen von einander noch jederseits zwei im Verlaufe des Pronotums, von denen hohe, Querwülsten ähnliche Leisten schräg nach hinten an den Seitenrand führen. Die 4 vorderen Schenkel sind, besonders unten, mit Lappenzähnen besetzt, die Hinterschenkel tragen auf der drittletzten und der vorletzten Querriefe der Aussenfläche je einen gelben ziemlich hohen stumpfkieligen Höcker. Long. tot. ♂ 9,5, ♀ 11 mm.

Die Gattung *Tondanotettix* würde nach der Characterisierung WILLEMSES mit *Hyboella* HANC. 1915 zusammen fallen. Die hier vorliegenden Arten von *Tondanotettix* zeigen aber wenig Verwandtschaft mit den bei *Hyboella* vereinigten Arten, und man wird die Gattung *Tondanotettix* WILL. am besten bei behalten. Von *Hyboella* HC. ist *Tondanotettix* am ehesten durch die tief unter den Augen inserierenden Fühler zwischen denen die Stirnkiele sehr stark vorgebuchtet sind, und das Vorhandensein von Zähnen zumindest an der Unterseite der 4 vorderen Schenkel zu scheiden.

Tondanotettix modestus n. sp. Fig. 22, 23.

1 ♂, Nordcelebes, Matinangebirge (Südseite), 1000 m, VIII.1894. Dres. SARASIN legrnt., Mus. Basel (Paratypus); 3 ♂♂, 2 ♀♀, Nordcelebes, Ile Ile, 500 m, XI.XII.1930, G. HEINRICH leg., Mus. Berlin (Holo- und Allotypus, Paratypen).

Von der vorhergehend beschriebenen *Tondanotettix brevis meridionalis* durch fast glattes, bedeutend geringer sculpturiertes Pronotum geschieden.

Dunkel- oder hellbraun, mit einer deutlich helleren braungelben, zuweilen (Ile Ile) fast gelbroten Querbinde über die Hinterschenkel und ähnlichen, aber weniger deutlichen Ringen um die 4 vorderen Schenkel, die Basis der Krallenglieder und den hinteren Metatarsus.

Scheitel, Stirnkiele wie bei der vorherigen Form, Antennen mit 14 Gliedern, das letzte stark verkürzt, 10.-12. schwarz, die übrigen gelb. Pronotum breit, mit kräftigen Kielen, auch der Prozona, Seitenkiele einfach; nicht dachförmig, in der Längsrichtung jederseits vom Mittelkiel flach concav hinter den Schultern, grob punctiert; glatt, aber mit 3-4 deutlichen Höckern jederseits vom

Mittelkiel, von welchen Höckern schwache Schräg- oder Querrunzeln zum Seitenrand hin verlaufen, daneben treten noch weitere, oft undeutliche und unvollständige Schräg- und Querrunzeln auf, die meist vom Seitenrand ausgehen. Pronotumseitenlappen stumpf, deutlich auswärts gewendet. Hinterschenkel mit kräftigen Querriefen aussen, deren drittletzter mit knotenartigem Höcker versehen sein kann. 1. und 3. Hintertarsenglied gleichlang, von den drei Pulvillen des hinteren Metatarsus sind die beiden vorderen oder zumindest der 2. spitz, aber nicht gedornt, der 3. stumpf und grösser, aber kaum länger als jeder der beiden anderen.

Pseudoparatettix nov. gen.

Diese Gattung ist in der vorn (cf. p. 172) gegebenen Bestimmungstabelle der Gattungen so gut, wie es möglich ist, characterisiert, es ist dem hier nichts hinzu zu setzen. Als den Genustypus bezeichne ich *Pseudoparatettix lineatus* HANC. 1907 (= *Paratettix histricus* HANC. 1907, nec STÅL, = *Bolotettix exiguus* K. GTHR. 1935). Die geographische Verbreitung des Genus erstreckt sich über ganz Südostasien, doch sah ich noch keine Vertreter von Java.

Die Gattung ist gegen *Mazarredia* BOL., *Bolotettix* HANC. (HANC. 1915) und gegen *Paratettix* BOL. nicht abzugrenzen. Zu *Pseudoparatettix* rechne ich ausser der Typusart die im Folgenden beschriebene, ferner die als *Xistra lurida* BOL. und *Paratettix angulobus* HANC. 1907 beschriebenen Arten; bei *Ps. luridus* ist der Seitenlappen des Pronotums völlig anliegend und abgerundet, bei *Ps. angulobus* und *Ps. lineatus* abgeschnitten und kräftig, resp. schwach nach aussen gewendet; ich sah die Typen dieser Arten.

Eine Anzahl ähnlicher Arten, bei denen die Stirnkiele in Profilansicht nicht vor die Augen treten, die Antennen deutlich unterhalb der Augenunterränder inserieren und der Scheitel, von oben gesehen, nicht nach vorn verschmälert ist, mit ± leistenförmig ausgebildeten Pronotumkielen, bilden den Uebergang zu *Mazarredia,* zu *Bolotettix,* wie HANCOCK diese Gattung 1915 auffasste, und zu *Parattettix* [1]).

Pseudoparatettix luwuensis n. sp. Fig. 25, 26.

1 ♀, Centralcelebes, Lempongpangi, ca 500 m, 6.II.1895, Dres. SARASIN legrnt., Mus. Basel.

Scheitel, von oben gesehen, nach vorn stark verschmälert, vorn schmäler als ein Auge, mit deutlichen, nach vorn gut abgegrenzten Gruben jederseits seines Mittelkieles. Augen gross, kugelig, seitwärts stark heraus stehend, nach oben aber das Pronotum kaum überragend. In Profilansicht treten die Stirnkiele nicht vor die Augen hervor, sie sind auch zwischen den Fühlerwurzeln kaum

[1]) Hier sind zunächst *Mazarredia ophthalmica* BOL. 1909 (= *Bolotettix inermis* HANC. 1915) und der ganz nahe verwandte ?*Bolotettix quadratus* K. GTHR. 1935, nec HANC. 1915 (Arb. morph. taxon. Ent. Brln.-Dahlem, II, p. 259, fig. 5) zu nennen, zu denen als nahe verwandt auch *Paratettix difficilis* K. GTHR. 1936 und noch eine Anzahl weiterer verwandter mir bekannter noch unbeschriebener und vermutlich auch beschriebener, mir unbekannter, Arten kommen; dann die jeweils recht isolierten Species *Mazarredia semperi* BOL., und *Xistra ochracea* BOL., die ich nach ihrem Typus kenne.

erhaben und unter ihnen nicht eingekerbt. Die Fühler inserieren zwischen den unteren Rändern der Augen. Vorderrand des Pronotums zwischen den parallelen oder kaum merklich nach hinten convergierenden Prozonaseitenkielen leicht nach vorn gebuchtet. Pronotum mit gleichmässig flach punctierter Oberfläche, nicht dachförmig, in der Schulterregion schwach gewölbt, mit zwar deutlich, aber nirgens leistenförmig erhobenen Seiten- und Mittelkiel, der lediglich über den Halsfurchen ein wenig erhoben ist. Zwischen den Schultern jederseits vom Mittelkiel halbseitlich ein abgekürzter, grader nicht erhabener Kiel. Die Seitenkiele des Pronotumfortsatzes sind nach vorn vorgezogen und verlaufen dort grade, innerhalb neben den eigentlichen Schulterkielen. Pronotumseitenlappen am Ende grade abgeschnitten, nicht auswärts gebogen. Elytren schmal und lang, Elytren das Pronotum nicht überragend. Schenkel glatt, Hinterschienen mit wenigen fast ganz obliterierten Dörnchen; 1. und 2. Glied der gelben Hintertarsen fast gleichlang, die 3 Pulvillen des hinteren Metatarsus gleichlang. Farbe grauviolett, doch dürfte dies ein Sonderfall des einzigen vorliegenden Exemplares sein. Long. tot. 15,5, pron. 14,8, fem. post. 6 mm.

Von *P. luridus* Bol. und *P. lineatus* Hanc. durch die in Seitenansicht nicht vor die Augen vortretenden Stirnkiel und durch den nicht über die Pronotumfläche erhobenen Kopf ausgezeichnet.

Loxilobus insidiosus Bol. 1887.

1 ♂, 1 ♀, Nordcelebes, Roeroekan, IV.1895, Dres. Sarasin lgrnt., Naturhist. Mus. Basel.

Diese Art könnte leicht auch bei *Mazarredia* Bol. vermutet werden; immerhin steht sie keiner der bei *Mazarredia* beschriebenen Arten, wohl aber anscheinend den kleineren *Loxilobus*-Arten nahe. Die Pronotumseitenlappen sind am Ende abgeschnitten und mit stumpfer Spitze ein wenig, aber deutlich, nach aussen gebogen. Ein besonderes Characteristicum der Art sind die zwischen den Augen ganz schwach concaven, in Seitenansicht deutlich hervortretenden Stirnkiele. Die Antennen inserieren unmittelbar unterhalb der Augen. Die Prozonaseitenkiele sind schwach gekrümmt und convergieren nach hinten ein wenig; deutlich ausgeprägt sind die Schultern und halbseitliche abgekürzte Kiele zwischen ihnen. Der Mittelkiel ist deutlich, aber kaum erhaben, in Seitenansicht jedoch ist sein Verlauf unregelmässig, mitunter, wie bei diesen Stücken von Celebes, eng wellig und höckerig. Immer sind Elytren und das Pronotumende nicht überragende Alae vorhanden. Maasse der hier vorliegenden Exemplare: long. tot. ♂ 7, ♀ 7,6 mm, long. pron. ♂ 6,4, ♀ 6,9 mm; sie sind durch kleinere und etwas schmächtigere Statur verschieden von den mir sonst aus Insulinde bekannten Angehörigen dieser Art.

Loxilobus rugosus celebensis n. ssp. Fig. 27, 38.

1 ♀, Südcelebes, Patoenoeang, I.1896, H. Fruhstorfer leg., Mus. Wien.

Scheitel, von oben gesehen, nach vorn stark verjüngt, am Vorderrande ganz wenig schmäler als ein Auge, mit kräftig markierter nach vorn deutlich

begrenzter Grube jederseits des undeutlichen Mittelkieles. Stirnkiele, von der Seite gesehen, deutlich vor die Augen vortretend und fast grade bis zum Puncte ihrer weitesten Vorbuchtung zwischen den Fühlerwurzeln verlaufend, die neben den unteren Augenrändern inserieren; unterhalb der Fühlerwurzeln sind die Stirnkiele schwach eingekerbt. Endglieder der Palpen gelb und stark verbreitert.

Prozonaseitenkiele undeutlich, parallel oder unmerklich nach hinten convergierend. Mittel- und Seitenkiele schwach ausgeprägt, der Mittelkiel ist auf der Prozona fast obliteriert und auf dem Pronotumfortsatz wiederholt unterbrochen. Zwischen den Schultern halbseitliche parallele oder nach hinten unmerklich divergierende abgekürzte Kiele. Pronotumoberfläche völlig eben, Schulterregion nicht erhoben und keine Andeutung von Gruben hinter ihr, überall rauh durch zerstreute längliche Höckerchen. Pronotumseitenlappen abgeschnitten, mit stumpfer Spitze wenig, aber deutlich, nach aussen gewendet. Elytren schmal und kurz, Alae das Pronotumende nicht überragend. Schenkel glattrandig. Hinterschienen bedornt; 1. Glied der Hintertarsen länger als 3., von den spitzen, aber nicht gedornten Pulvillen des hinteren Metatarsus ist der 3. bedeutend länger als jeder der beiden anderen. Long. tot. 9,8, pron. 8,8, fem. post. 6,2 mm.

Es ist zu erwarten, dass von dieser Art auch Exemplare mit stärker verlängertem Pronotum gefunden werden *L. celebensis* ähnelt den Arten *L. rugosus* BOL. von Borneo und *L. truncatus* HC. von Borneo; sie ist von *rugosus* BOL. durch kürzere Antennen und rauheres Pronotum, von *truncatus* durch grössere Breite in den Schultern und rauheres Pronotum geschieden.

Spadotettix heinrichi nov. spec. Fig. 39, 40.

1 ♀, Nordcelebes, Kalabat, 250 m, III.1931, G. HEINRICH leg., Zool. Mus. Berlin.

Scheitel, von oben gesehen, breiter als ein Auge, mit undeutlichem, ihn ganz durchlaufenden Mittelkiel und jederseits von ihm einer Grube, deren vordere Begrenzungsleisten deutlich sind und, wegen der Verlängerung des Scheitels nach vorn, vom Augenvorderrand schräg nach vorn zum Mittelkiel des Scheitels hin verlaufen. In Profilansicht Kopf und Augen nicht exseriert, Scheitel um etwa ¼ der Augenbreite nach vorn in einen stumpfen Zapfen verlängert; Stirnkiele auf ihrem Abfall stark concav, zwischen den Fühlerwurzeln, die neben den unteren Augenrändern inserieren, kaum vortretend, unter ihnen nicht eingekerbt. Pronotum stark verlängert, mit schwach leistenförmig erhabenen Kielen, Oberfläche fast glatt, mit gewölbter Schulterregion und dahinter liegender grubiger Einsenkung. Prozonakiele gekrümmt, fast parallel, halbseitliche abgekürzte Schulterzwischenkiele parallel. Pronotumseitenlappen am Ende grade abgeschnitten, mit stumpfer Spitze wenig aber deutlich auswärts gebogen. Elytren am Ende breit abgerundet, Alae fast nicht das Pronotumende überragend. Schenkel glattrandig, Hinterschienen nur spärlich gedornt; 1. und 3. Hintertarsenglied fast gleichlang, die 3 Pulvillen des hinteren Metatarsus stumpf und fast gleichlang. Long. tot. 19, pron. 17, fem. post. 7 mm. Farbe braun, an

den Pronotumseitenlappen und Hinterschenkeln mit schwarz marmoriert, Elytren und Costalteil der Alae fast ganz schwarz.

Die Bildung des Kopfes bei dieser Art entspricht fast völlig der von HANCOCK für *Spadotettix fletcheri* Hc. gegebenen Abbildung (Spolia Zeylanica, VI, 1910, p. 147, figg. 1, 2); nur ist der Stirnzapfen bei der neuen Art kürzer und, von oben gesehen, die Vorder- und Seitenrandleisten der Scheitelgruben bei *Sp. heinrichi* mehr schräg vom Augenvorderrand zum Scheitelmittelkiel verlaufend zu denken, während sie bei *Sp. fletcheri* abgerundet fast rechtwinklig verlaufen.

Systolederus carli celebensis n. ssp. Fig. 28, 31.

2 ♂♂, Südcelebes, Samanga, XI.1895, FRUHSTORFER leg., Mus. Hamburg; 2 ♀♀, vom gleichen Fundort, Mus. Stettin.

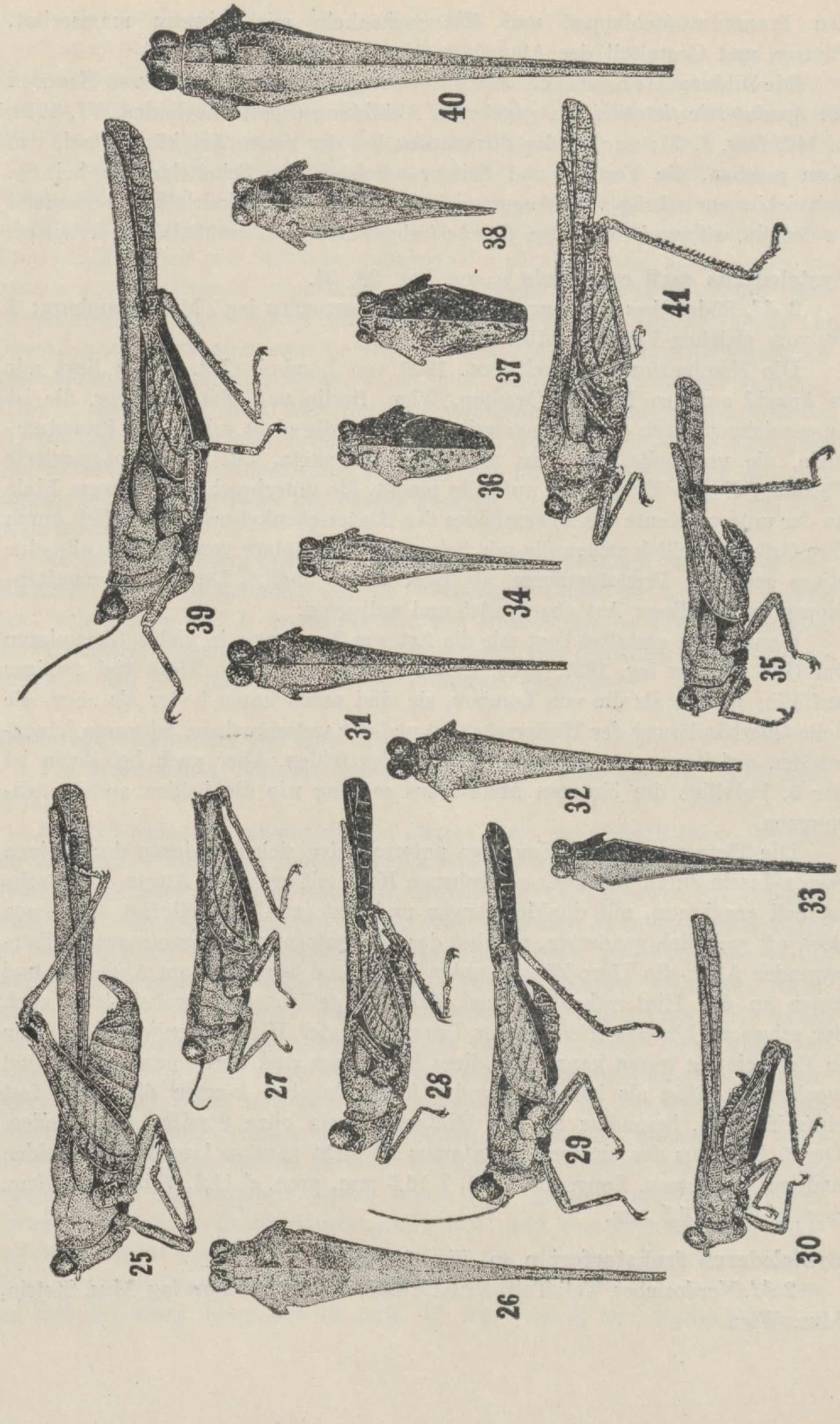
Die Nominatform *S. carli* BOL. 1909 von Lombok (Mt. Sapit) liegt mir in Anzahl aus den Museen Dresden, Wien, Berlin und Hamburg vor. Sie ist ausgezeichnet durch den hoch exserierten Kopf, die nicht erhabenen Pronotumkiele, die unterseits, auch an den Hinterschenkeln, mit weiss marmorierte Färbung, die die Tiere recht auffällig macht, die unterbrochene schwarze Linie an der unteren Kante des Aussenfeldes der Hinterschenkel und schliesslich durch ihre Grösse. Freilich zeigen die mir bekannten Exemplare von Lombok alle eine etwas geringere Pronotumlänge, als BOLIVAR sie angibt. Der Pronotumseitenlappen ist bei dieser Art abgerundet und anliegend.

Ganz gleich gestaltet liegt mir die Art von Soembawa in vielen Exemplaren vor (Dr. RENSCH leg. 1927, Mus. Berlin); doch sind diese Tiere viel weniger auffällig gefärbt als die von Lombok, sie sind unten kaum heller als oben, die helle Querbänderung der Hinterschenkel und der unterbrochene schwarze Längsstreifen auf ihnen sind ganz undeutlich oder fehlen. Aber auch bei ihnen ist der 3. Pulvillus des hinteren Metatarsus so lang wie die beiden anderen zusammen.

Die Tiere von Celebes-Samanga unterscheiden sich von denen der Kleinen Sunda-Inseln durch den stärker erhobenen Kopf mit grösseren Augen. Die Farbe ist hell graubraun, mit dunklen Augen und fast im Costalteil fast schwarzen doch oft weisslich geaderten, wie bei der Stammform das Pronotumende überragenden Alae; die Tiere können unten heller und besonders am Abdomen und unten an den Hinterschenkeln fast weisslich gefärbt sein, wobei dann auch der schwarze Längsstreifen an der Unterkante der Hinterschenkelaussenfläche in Erscheinung treten kann. Alle diese Färbungen sind aber verwaschener und weniger auffällig als bei der Nominatform; daneben können die Tiere fast einfarbig sein, besonders an den Hinterschenkeln ohne Streifen und Binden. Der 3. Pulvillus des hinteren Metatarsus ist nicht ganz so lang wie die beiden anderen zusammen. Long. tot. ♂ 13, ♀ 16,5 mm, pron. ♂ 11,5, ♀ 13,5 mm, fem. post. ♂ 5,5, ♀ 6,5 mm.

Systolederus fruhstorferi n. sp. Fig. 29, 32.

2 ♂♂, Nordcelebes, Toli Toli, XI.XII.1895, H. FRUHSTORFER leg. Mus. Stettin, Mus. Wien.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Dieses Tier ist hell- oder dunkelbraun, mit hellerem Streifen über den unteren Rand des Pronotumseitenlappens, über das Meso- und Metapleuron und die äussere Hinterschenkelfläche, die untere äussere Hinterschenkelpartie dunkelbraun bis schwarz. Alae schwarz mit weisslichen Adern, sie überragen nicht das Pronotum. Im übrigen stimmt die Art mit der vorigen überein und ist ihr sehr ähnlich; jedoch weicht sie durch die stumpf abgeschnittenen und sehr deutlich, wenn auch nur wenig nach aussen gewendeten Pronotumseitenlappen ab. 3. Pulvillus des hinteren Metatarsus deutlich länger als jeder der beiden anderen zusammen.

Es ist sicher, dass dieses Tier nicht zu der vorigen und zu überhaupt keiner beschriebenen *Systolederus*-Art gehören kann. *S. ophthalmicus* von Nordcelebes (Minahassa) ist durch grubenartige Einsenkung der Pronotumoberfläche hinter den Schultern, durch leistenartigen, comprimiert erhabenen Mittelkiel des Pronotums und 3 gleichlange Pulvillen des hinteren Metatarsus ausgezeichnet, vielleicht auch durch nur wenig exserierten Kopf; ich kenne die Art nur nach der Beschreibung, die sie sehr verschieden von den beiden hier vorliegenden *Systolederus*-Arten erscheinen lässt.

Coptotettix alfurus n. sp. Fig. 16, 17, 36, 37.

1 ♂, Südcelebes, Lompo Batang, über 2500 m, Dres. Sarasin legrnt., Mus. Basel.

Scheitel, von oben gesehen, breiter als ein Auge, mit einigen wenigen Körnern, mit undeutlichem Mittelkiel und undeutlichen Gruben jederseits von ihm, die aber nach vorn mit deutlicher Leiste begrenzt sind. Scheitel in Seitenansicht ganz wenig nach vorn und oben über die Augen tretend; Stirnkiel senkrecht und grade nach unten abfallend, er beginnt sich erst unterhalb der Augenmitte zu teilen, zwischen den Fühlerwurzeln vorgebuchtet, unter ihnen deutlich eingekerbt. Die oberen beiden Ocellen befinden sich zwischen den unteren Augenhälften, zu Beginn der Teilung des Stirnkieles; die Antennen inserieren deutlich unterhalb der Augenunterränder. Pronotum mit gradem Vorderrand, sehr stark dachförmig; Prozonaseitenkiele scharf erhaben, nach hinten divergierend, Mittelkiel ebenfalls zusammen gedrückt und leistenförmig erhaben, in Profilansicht über Prozona und Schulterregion stark erhöht und flach gebogen, nach hinten abfallend. Seitenkiele deutlich, an den Schultern nicht doppelt.

Pronotum das Abdominalende nicht erreichend, hinten abgerundet; seine Oberfläche ist rauh, von den Schultern nach dem Ende hin zunehmend mit verstreuten Körnern und Höckerchen besetzt, hinter der Schulterregion beiderseits vom Mittelkiel deutlich grubig eingesenkt. Pronotumseitenlappen breit abgerundet, nicht auswärts gebogen. Flugorgane fehlen. Schenkel glatt, Hinterschienen gedornt, Hintertarsen lang, mit deutlich als der Metatarsus längerem 3. Gliede; die drei Metatarsalpulvillen gestreckt, beinahe gleichlang. Farbe grau, Pronotummittelkiel ockerfarben, je ein unregelmässiger schwarzer Fleck

in den grubigen Posthumeraleinsenkungen; Hinterschenkel mit winzigen weissen Flecken an der Unterkante und an der unteren Grenzleiste der Aussenfläche. Vorderschenkel und -Schienen mit hellen ± vollständigen Ringen, Hintertarsen gelb. Long. tot. 7,8, pron. 5, fem. post. 5 mm.

Es liegt noch ein ♀ vor (Abb. 17, 37; Celebes, Latimodjonggebirge, Pasoei, 600 m, 1930, G. HEINRICH leg., Zool. Mus. Berlin), das vielleicht der gleichen, wahrscheinlicher aber einer anderen, nahe verwandten Art angehören dürfte. Das Tier ist dem beschriebenen ♂ ähnlich, sein Scheitel ist auch breiter als ein Auge, nach vorn nicht verjüngt und dicht gekörnelt; in Seitenansicht tritt der Stirnkiel, der sich auch erst zwischen den unteren Augenhälften, neben den oberen Ocellen, zu gabeln beginnt, kaum oder nicht vor die Augen hervor, er geht mehr gerundet als bei dem ♂ in den Scheitel über. Die sehr kurzen Antennen inserieren dicht unterhalb der Augen. Pronotum ähnlich wie des des oben beschriebenen ♂, nicht mit Höckerchen auf dem hinteren Teile, sondern mit ganz unregelmässigen Höckern und Vertiefungen. Mittelkiel, in Seitenansicht, bis über die Schultern hin zunächst deutlich ansteigend. Pronotum hinten abgerundet und in der Mitte eingekerbt. Seitenlappen breit gerundet am Ende, kaum, jedenfalls nicht über die Deckstücke der Mittelhüften hinaus, auswärts gebogen. Schenkel fast glatt, Hinterschienen gedornt, 3. Hintertarsenglied wesentlich kürzer als der Metatarsus, dessen 3 Pulvillen fast gleichlang sind. Einfarbig graubraun. Long. tot. 8, pron. 5,5, fem. post. 5 mm.

Die hier beschriebene oder die beiden hier beschriebenen Arten könnten auch bei *Acrydium* oder eher noch bei *Apterotettix* HANC. 1902 stehen; doch herkömmlicher Weise werden diejenigen Arten, in deren Verwandtschaftskreis auch die hier besprochenen Formen gehören, zu *Coptotettix* BOL. gestellt. Solche verwandten Arten sind z.B. *C. parvulus* HANC. 1912, *C. fossulatus* BOL. 1887, *C. pusillus* HEB. 1919; von diesen (indischen) Arten hat *C. fossulatus*, ebenso wie die übrigen etwa nahe stehenden Formen, Elytren und Flügel, *C. parvulus* und *C. pusillus* sind kleiner, der erstgenannte hat wenigstens Elytren, der andre eine wesentlich glattere Pronotumfläche.

Coptotettix interruptus BOL. 1887.

1 ♂, Südcelebes, Samanga, XI.1895, FRUHSTORFER leg., Mus. Hamburg.

Der Typus der Art aus dem Wiener Museum liegt mir vor, das genannte ♂ gehört unzweifelhaft zur gleichen Art.

Euparatettix celebicus HANCOCK 1907. Fig. 30, 33.

1 ♀, Südcelebes, Samanga, XI.1895, FRUHSTORFER leg., Mus. Hamburg.

Diese Art, obwohl von ihrem Autor als *Hedotettix* beschrieben, ist ein echter *Euparatettix*, mit nach vorn nicht verbreitertem Scheitel, wie auch in der Originalbeschreibung angegeben ist. Ich sah den ♂ Typus aus dem Museum Oxford. Es besteht grosse Aehnlichkeit zu *E. personatus* BOL. 1887, *Paratettix histricus* STAAL (= *P. variabilis* BOL.) und besonders *Euparatettix tricarinatus*

BOL. 1887. Der einfarbig dunkelbraune *E. celebicus* ist von *E. personatus* durch schmäleren Scheitel, in Profilansicht fast graden, in der Schulterregion nur unmerklich erhobenen Pronotummittelkiel und fehlenden weissen Basalring der Hinterschienen geschieden; *E. tricarinatus* hat längeres Pronotum mit fast ganz grade verlaufendem Mittelkiel, er erscheint schmäler (noch länger ist der mir unbekannte *E. tenuis* HANC. 1912), *Paratettix histricus* ist breiter mit wie bei *E. personatus* erhobener Schulterregion.

Euparatettix personatus BOL. 1887.

1 ♂, Südwestcelebes, Makassar, Dres. SARASIN legrnt. XII.1894, Mus. Basel; 3 ♀♀, Makassar, Capt. CONRAD leg., 2 ♀♀, Latimodjong-Gebirge, Oeroe, 800 m, VIII.IX.1930, G. HEINRICH leg., Mus. Berlin; 1 ♀, Südcelebes, Patoenoeang, I.1896, FRUHSTORFER leg., Mus. Hamburg.

Alle Exemplare besitzen den der Art fast niemals fehlenden weissen Basalring der Hinterschienen.

Paratettix histricus STÅL 1860.

1 ♂, 1 ♀, Südcelebes, Samanga, XI.1895, FRUHSTORFER leg., Mus. Hamburg; 1 ♂, Südwestcelebes, Makassar, Capt. CONRAD leg., Mus. Berlin.

Von dieser Art sah ich den Typus (Java, Mus. Stockholm) und eine Unzahl anderer Exemplare, die hier vorliegenden stimmen mit ihnen überein. Den *Paratettix variabilis* BOL. 1887 halte ich für die gleiche Art, wie genau in Rev. Suisse Zool. auseinander gesetzt wird.

? **Paratettix femoralis** BOL. 1887. Fig. 34, 35.

1 ♀, Südcelebes, Patoenoeang, FRUHSTORFER leg., Mus. Stettin.

Dieses Exemplar stimmt mit den mir zahlreich von Nordaustralien, Neu Guinea und den Molukken vorliegenden Stücken dieser Art überein, hat aber vielleicht einen etwas breiteren Scheitel — dergleichen ist sehr schwer zu constatieren. Seine Totallänge beträgt 12, die des Pronotums 9,2 mm. Ein vom gleichen Fundort vorliegendes ♂ gehört vielleicht dazu, bei ihm treten aber in Profilansicht die Stirnkiele nach oben sanft gerundet bis unmittelbar an den Augenrand zurück, und so ist es hinlänglich von dem ♀ unterschieden (long. tot. 11,5, pron. 9 mm).

Paratettix spec.

1 ♀, Nordcelebes, Toli Toli, XI.XII.1895, FRUHSTORFER leg., Mus. Stettin.

Dieses schlecht erhaltene Exemplar vermag ich keiner bekannten Art zuzuordnen. Es gleicht ein wenig dem *P. variegatus*, von dem mir Stücke von Ceylon, Malaya und Karimon Djawa (!) vorliegen, doch sind die Stirnkiele in Profilansicht vor den Augen nicht concav, und das Tier ist zu klein: long. tot. 10,8, pron. 9 mm.

Indatettix spec.

1 ♀, Nordcelebes, Toli Toli, XI.XII.1895, FRUHSTORFER leg., Mus. Stettin. Einfarbig hellbraun, mit fast gleichmässig (von der Seite gesehen, ungewellt) verlaufendem Pronotummittelkiel; long. tot. 13, pron. 10 mm.

Die Möglichkeit der Identität zumindest der zahlreich aus Vorder- und Hinterindien beschriebenen Arten erörtert HEBARD, Rev. Suisse Zool., XXXVI, 1929, p. 587/8.

? Hedotettix costatus HANCOCK 1912. Fig. 41.

1 ♂, 2 ♀♀, Südcelebes, Samanga und Patoenoeang, XI.1895, I.1896, FRUHSTORFER leg., Mus. Stettin; 4 ♂♂, Samanga, Mus. Hamburg.

Diese Exemplare gleichen fast völlig *H. gracilis* DE HAAN, doch in Profilansicht stossen Scheitel und Stirnkiele unter einem deutlich vorspringenden Winkel zusammen, dadurch sind sie von *H. gracilis* auffällig verschieden. Der Scheitel, von oben gesehen, verengert sich zunächst nach vorn bis zur Mitte der Augen und verbreitert sich danach wieder bis zu seinem Vorderrande. Das Pronotum ist gekörnelt.

Genau übereinstimmend liegen mir vor 1 ♂, 1 ♀, Malaya, Parit Buntar, H. T. PAGDEN leg. 1930; weitere Tiere von diesem Fundorte befinden sich im British Museum und Fed. Mal. St. Mus. Kuala Lumpur. Die Maase aller dieser Exemplare sind: long. tot. ♂ 13, ♀ 15 mm, pron. ♂ 10,2, ♀ 11,5 - 13 mm. Sie entsprechen genau der Beschreibung des *Hedotettix costatus* HANC. 1912 (Mem. Dept. Agric. Ind., Ent. Ser., IV, p. 147), nur dass dort der Scheitel als nach vorn sich verengernd angegeben wird, was aber der Gattungsdiagnose von *Hedotettix* BOL. widerspräche.

Da *Hedotettix gracilis* von DE HAAN nach Stücken aus Nordcelebes beschrieben wurde (cf. WILLEMSE 1928, 1931), halte ich für möglich, dass jenem Autor solche wie die besprochenen und abgebildeten Exemplare für seine Beschreibung vorlagen. Wenn dem wirklich so wäre, würde der *Hedotettix gracilis* autorum (cf. KIRBY, Faun. Brit. Ind., *Acrididae,* 1914, fig. 64) in Zukunft als eine von *H. gracilis* DE HAAN verschiedene Art angesehen werden müssen.

VERZEICHNIS DER ABBILDUNGEN.

Fig. 13. *Tegotettix armatus* HANC., ♀, Paloe-Tal, seitlich.
— 14. *Tegotettix corniculatus celebensis* n. ssp., ♂, seitlich.
— 15. *Tegotettix armatus* HANC., ♀, Paloe-Tal, von oben.
— 16. *Coptotettix alfurus* n. sp., ♂, Lompo Batang, seitlich.
— 17. *?Coptotettix alfurus* n. sp., ♀, Latimodjong-Geb., von oben.
— 18. *Bullaetettix sarasinorum* n. g. n. sp., ♂, seitlich.
— 19. — — — , ♂, von oben.
— 20. *Tondanotettix brevis meridionalis* n. ssp., ♀, Lompo Batang, seitlich.
— 21. — — — — , ♀, — — von oben.
— 22. *Tondanotettix modestus* n. sp., ♀, Ile Ile, seitlich.
— 23. — — — , ♀, — , von oben.
— 24. *Tegotettix corniculatus celebensis* n. ssp., ♂, von oben.
— 25. *Pseudoparatettix luwuensis* n. g. n. sp., ♂, seitlich.
— 26. — — — , ♂, von oben.
— 27. *Loxilobus rugosus celebensis* n. ssp., ♀, seitlich.
— 28. *Systolederus carli celebensis* n. ssp., ♂, seitlich.
— 29. *Systolederus fruhstorferi* n. sp., ♂, seitlich.
— 30. *Euparatettix celebicus* HANC., ♂ Typus (Mus. Oxford), Makassar, seitlich.
— 31. *Systolederus carli celebensis* n. ssp., ♂, von oben.
— 32. *Systolederus fruhstorferi* n. sp., ♂, von oben.
— 33. *Euparatettix celebicus* HANC., ♂ Typus, von oben.
— 34. *?Paratettix femoralis* BOL., ♀, Patoenoeang, von oben.
— 35. *?* — — — , ♀, — , seitlich.
— 36. *Coptotettix alfurus* n. sp., ♂, Lompo Batang, von oben.
— 37. *?Coptotettix alfurus* n. sp., ♀, Latimodjong-Geb., seitlich.
— 38. *Loxilobus rugosus celebensis* n. ssp., ♀, von oben.
— 39. *Spadotettix heinrichi* n. sp., ♂, seitlich.
— 40. — — — , ♂, von oben.
— 41. *?Hedotettix costatus* HANC., ♀, seitlich.

NEW CERAMBYCID BEETLES BELONGING TO THE GENUS *OBEREA* FROM JAVA

By

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Among a collection of Cerambycid beetles received from F. C. DRESCHER for identification, the following new species belonging to the genus *Oberea* were found.

My sincere thanks are extended to Mr. DRESCHER for his kindness in permitting me to deposit the types of all the new species in the United States National Museum at Washington. Paratypes of all the species described have been placed in the collection of F. C. DRESCHER.

Additional specimens of *O. drescheri* FISHER and *O. javaensis* FISHER were received from Mr. M. A. LIEFTINCK, and these have been placed in the collection of the Buitenzorg Museum.

Oberea javaensis, new species.

Male. — Rather narrow, slightly attenuate posteriorly; head and thorax reddish yellow; antenna black, with the eleventh joint and apical half of the tenth joint whitish; elytra black or brownish black, more or less yellowish basally; body beneath and legs entirely black or brownish black.

Head distinctly wider than pronotum, the front feebly convex, transverse, feebly depressed between the antennal tubercles, and with a longitudinal, median carina or groove extending from epistoma to occiput; surface finely, densely punctate, with numerous coarse, shallow punctures intermixed, rather densely clothed with short, recumbent, golden yellow pubescence, with a few erect, brownish hairs intermixed; eyes large; antenna considerably longer than body.

Pronotum slightly longer than wide; sides nearly parallel, vaguely expanded or sinuate at middle; disk feebly, broadly, transversely flattened or depressed along base and anterior margin; surface sparsely, feebly, irregularly punctate, clothed with pubescence similar to that on the head. Scutellum subtriangular, broadly truncate at apex.

Elytra slightly wider at base than pronotum, extending nearly to apex of abdomen; sides feebly, broadly constricted from near base to apical sixth, then obliquely narrowed to the tips, which are separately obliquely emarginate and bidentate; disk strongly flattened; surface coarsely, seriately punctate basally,

becoming obsoletely punctured toward apices, the lateral halves sparsely clothed with very short, recumbent, brownish pubescence, and the sutural halves with denser, longer, whitish pubescence, with a few inconspicuous, erect, whitish hairs intermixed.

Body beneath finely, densely granulose, sparsely, coarsely, irregularly punctate, rather densely, uniformly clothed with moderately long, recumbent and erect, whitish hairs intermixed; last abdominal segment broadly, triangularly depressed posteriorly, transversely truncate and feebly emarginate at apex; posterior femora extending to anterior margin of second abdominal segment.

Female. — Differs from the male in having the pronotum slightly wider than long, and the last abdominal segment convex, longitudinally carinate or grooved at middle, and broadly subtruncate at apex.

Length, 11.5 - 17 mm; width, 1.75 - 2.75 mm.

Type locality. — Central Java: Batoerraden, Mt. Slamat.

Described from 39 specimens (one male type), all collected in Java. The type and 8 paratypes were collected at the type locality, at an altitude of 800 meters, by F. C. DRESCHER; 12 paratypes on Noesa Kambangan Island, at an altitude of 100 meters, by F. C. DRESCHER; 5 paratypes at Koebangkangkoeng, at an altitude of 25 meters, by F. C. DRESCHER; 6 paratypes at Mt. Raoeng, Bajoekidoel, at an altitude of 450 to 700 meters, 4 by F. C. DRESCHER and 2 by H. LUCHT; 2 paratypes at Mt. Tjisoeroe, Djampangs, at an altitude of 600 to 700 meters, by Mrs. M. E. WALSH; 2 paratypes at Babakan, during March 1933, by F. C. DRESCHER; 1 paratype at Mt. Raoeng, Blawan, at an altitude of 900 to 1500 meters, by Dr. L. J. TOXOPEUS; 1 paratype at Mt. Raoeng, Kawah Idjen, at an altitude of 2100 meters, by Dr. L. J. TOXOPEUS; and 1 paratype at Preanger, Mt. Tangkoeban Prahoe, at an altitude of 1400 meters, October 17, 1928 by F. C. DRESCHER.

Additional material from West Java in the Buitenzorg Museum. — 1 ♂, 1 ♀, Djampang Tengah, Mt. Tjisoeroe, 600 - 800 m, November 1933, M. E. WALSH; 1 ♂, Mt. Sanggaboeana, 500 m, December 22, 1935, M. A. LIEFTINCK; 1 ♀, Mt. Salak, 600 m, June 1936, M. A. LIEFTINCK; 1 ♀, Palaboean Ratoe, sea-level, October 1933, M. E. WALSH.

This species differs from *insularis* FISHER in being more robust and more strongly attenuate posteriorly, in having the pronotum transversely depressed along the anterior margin, and in having the apical joints of the antenna whitish.

Oberea insularis, new species.

Male. — Narrow, linear; head and pronotum reddish yellow; antenna uniformly black or reddish brown; elytra black or reddish brown, more or less reddish yellow basally; body beneath black, except the prosternum, anterior and middle coxae, and legs, which are reddish yellow.

Head distinctly wider than pronotum, the front rather narrow, elongate, nearly flat, feebly constricted between the eyes, slightly depressed between the antennal tubercles, and with a longitudinal, median carina or groove extending

from epistoma to occiput; surface finely, vaguely punctate, with numerous coarse, shallow punctures intermixed, sparsely clothed with moderately long, inconspicuous, recumbent, yellowish pubescence, with a few long, erect hairs intermixed; eyes rather large; antenna about as long as the body.

Pronotum distinctly longer than wide; sides parallel and vaguely sinuate; disk rather uniformly convex; surface coarsely, sparsely, irregularly, vaguely punctate, rather densely clothed with long, recumbent, inconspicuous, yellowish pubescence, with a few long, erect hairs intermixed. Scutellum subtriangular, broadly rounded at apex.

Elytra scarcely wider at base than pronotum, subparallel, extending nearly to apex of abdomen; sides vaguely constricted from near base to apical sixth, the tips obliquely truncate and bidentate; disk strongly flattened; surface coarsely, seriately punctate, the lateral halves sparsely clothed with very short, recumbent, brownish pubescence, and the sutural halves with longer, whitish pubescence, with a few inconspicuous, erect hairs intermixed.

Body beneath finely, densely granulose, rather densely, coarsely, irregularly punctate, densely clothed with long, recumbent, whitish pubescence, with a few long, erect hairs intermixed; last abdominal segment very broadly and deeply concave posteriorly, with long hairs at apex; posterior femora extending to anterior margin of second abdominal segment.

Female. — Differs from the male in having the front of the head slightly transverse, antenna shorter than body, the pronotum nearly quadrate, with the sides feebly expanded at middle and the surface more coarsely punctured and sparsely pubescent; and the last abdominal segment convex, longitudinally carinate or grooved at the middle, and broadly, arcuately emarginate at apex.

Length, 10.5 - 13 mm; width, 1.25 - 1.5 mm.

Type locality. — South Java: Noesa Kambangan Island.

Described from 4 specimens (one male type). The type and 2 paratypes were collected at the type locality, at an altitude of 100 meters, during December 1925, by F. C. DRESCHER, and 1 paratype was collected at Mt. Tjisoeroe, Djampangs, West Java, at an altitude of 600 to 700 meters, during December 1934, by Mrs. M. E. WALSH.

The coloration in this species is more or less variable. One of the paratypes has the elytra nearly uniformly reddish yellow and the anterior and middle legs in part brownish.

This species differs from *pictipes* PASCOE in being more slender; in having the head, pronotum, and at least the bases of the elytra reddish yellow; and in having the pronotum clothed with inconspicuous pubescence.

Oberea walshae, new species.

Female. — Short, moderately narrow, linear, black or dark brown, except the palpi, legs, coxae, last two abdominal segments, posterior margin of first three abdominal segments, base and longitudinal median vitta on each elytron,

and the third, fourth, fifth, seventh, and eighth antennal joints, which are brownish or yellowish white.

Head wider than pronotum, the front broad, feebly convex, transverse, with a longitudinal, median groove or carina extending from epistoma to occiput; surface finely, vaguely punctate, with numerous coarse punctures intermixed, sparsely clothed with inconspicuous, erect hairs, which are denser behind the eyes; eyes large; antenna longer than body.

Pronotum slightly wider than long, subequal in width at base and apex; sides parallel, feebly sinuate; disk feebly, broadly, transversely depressed along base and anterior margin; surface sparsely, coarsely, irregularly punctate, sparsely clothed with long, recumbent, whitish pubescence. Scutellum slightly transverse, subtriangular, broadly truncate at apex.

Elytra distinctly wider at base than pronotum, extending to apex of abdomen; sides parallel to near the tips, which are separately obliquely truncate and feebly bidentate; disk feebly flattened; surface rather densely, coarsely, irregularly punctate from bases to apices, sparsely clothed with short, inconspicuous, recumbent pubescence.

Body beneath finely, densely granulose, rather densely clothed with moderately long, recumbent, whitish pubescence, with a few long, erect hairs intermixed; last abdominal segment feebly, broadly depressed posteriorly, feebly, broadly, arcuately emarginate at apex; posterior femora extending to anterior margin of third abdominal segment.

Length, 8 mm; width, 1.75 mm.

Type locality. — West Java: Djampangs.

Described from two females (one type) collected at the type locality, at an altitude of 600 to 700 meters, during October 1934, by Mrs. M. E. WALSH.

This species differs from *luchti* FISHER in having the sixth joint of the antenna black; each elytron ornamented with a longitudinal, median yellowish white vitta; and in having the last two abdominal segments and the posterior margins of the other segments yellowish white.

Oberea luchti, new species.

Male. — Narrow, slightly attenuate posteriorly; head in part, thorax, mesosternum, and metasternum black or brownish black; antenna dark brown, except the intermediate joints, which are brownish white and narrowly annulated dark brown at apices; elytra, and abdomen beneath, pale brown, the former slightly paler at bases; palpi, legs, and coxae yellowish white, the tibiae in part slightly darker.

Head distinctly wider than pronotum, the front elongate, subtriangular, nearly flat, with a vague, longitudinal, median carina; surface finely, vaguely punctate, with numerous coarse punctures intermixed, rather densely clothed with moderately long, recumbent, whitish pubescence, with a few long, erect hairs intermixed; eyes large; antenna longer than body.

Pronotum quadrate, subequal in width at base and apex; sides parallel, feebly sinuate; disk feebly, broadly, transversely depressed along base and anterior margin; surface sparsely, coarsely, irregularly punctate, sparsely clothed with moderately long, recumbent, inconspicuous pubescence, with a few long, erect hairs intermixed. Scutellum slightly elongate, broadly rounded or subtruncate at apex.

Elytra distinctly wider at base than pronotum, slightly attenuate posteriorly, extending nearly to apex of abdomen; sides feebly, broadly constricted from near the base to apical sixth, where they are arcuately expanded, the tips separately obliquely truncate and feebly bidentate; disk rather strongly flattened; surface rather densely, coarsely, irregularly punctate basally, more finely punctate near apices, rather densely, uniformly clothed with moderately long, recumbent, whitish pubescence, with numerous long, erect hairs intermixed.

Body beneath finely, densely granulose, sparsely, coarsely punctate, rather densely clothed with long, recumbent, whitish pubescence, with a few erect hairs intermixed; last abdominal segment feebly depressed, arcuately emarginate at apex; posterior femora extending to middle of third abdominal segment.

Female. — Differs from the male in having the front of the head broad, transverse, and feebly convex, the pronotum slightly wider than long, and the last abdominal segment strongly convex, arcuately expanded laterally, with a narrow, longitudinal, median carina.

Length, 7 - 7.5 mm; width, 1.4 - 1.5 mm.

Type locality. — East Java: Mt. Raoeng (Idjen-Kendeng Mountains).

Described from one male (type) and three females collected at the type locality, at an altitude of 1100 meters, December 22, 1931, by H. LUCHT.

This species differs from *pictipes* PASCOE in being considerably shorter and narrower; in having the pronotum uniformly black or brownish black, and clothed with inconspicuous pubescence; the intermediate joints of the antenna yellowish white; and in having the elytra feebly, obliquely truncate at the tips, and without a longitudinal pubescent vitta along each sutural margin.

Oberea drescheri, new species.

Female. — Robust, attenuate posteriorly, uniformly pale brownish yellow (head and pronotum slightly darker), except the antennae, tips of mandibles, posterior tibiae in part, and apex of abdomen, which are black or dark brown.

Head slightly wider than pronotum, the front broad, feebly convex, slightly transverse, with a longitudinal, median groove or carina extending from epistoma to occiput; surface feebly, densely punctate, with numerous large punctures intermixed, sparsely clothed with short, inconspicuous, erect hairs; eyes large; antenna about as long as the body.

Pronotum slightly wider than long, subequal in width at base and apex; sides parallel, feebly sinuate; disk feebly, transversely depressed along base and anterior margin, more deeply in front of scutellum; surface coarsely, indistinctly, irregularly punctate, sparsely clothed with very short, erect, incon-

spicuous, brownish pubescence. Scutellum slightly transverse, broadly truncate at apex.

Elytra distinctly wider at base than pronotum, attenuate posteriorly, extending nearly to apex of abdomen; sides feebly, broadly constricted behind middle, obliquely narrowed near tips, which are separately obliquely emarginate and bidentate; disk strongly flattened; surface coarsely, seriately punctate basally, becoming obsoletely punctate near the apices, sparsely, uniformly clothed with short, recumbent, yellowish pubescence, which does not conceal the large punctures.

Body beneath finely, densely granulose, densely, uniformly clothed with short, inconspicuous, recumbent, yellowish pubescence; last abdominal segment with a narrow, longitudinal, median carina, broadly, arcuately emarginate at apex, clothed at apex with numerous stiff, erect, blackish setae and long, black hairs intermixed; posterior femora extending to anterior margin of third abdominal segment.

Length, 14 - 17 mm; width, 2.75 - 3.75 mm.

Type locality. — Central Java: Batoerraden, Mt. Slamat.

Described from six females (one type) collected by F. C. DRESCHER. The type and three paratypes were collected at the type locality, at an altitude of 800 meters, July 1928, July 17, 1927, May 15, 1927, and April 10, 1927; and two paratypes were collected at Mt. Tangkoeban Prahoe (Preanger), W. Java, at an altitude of 1400 meters, April 26, 1929, and April 1934.

Additional material from Sumatra and West Java in the Buitenzorg Museum. — 1 spec., N.E. Sumatra, Medan, Arnhemia, April 1928, J. C. VAN DER MEER MOHR; 1 spec., W. Sumatra, Loeboeksikaping, 450 m, 1923 - 1927, L. HUNDESHAGEN; 2 spec., W. Java, Djampang Tengah, Mt. Tjisoeroe, 600 m, November 1933, M. E. WALSH.

This species differs from *balineae* HELLER in being more strongly attenuate posteriorly, and in having the head, pronotum, elytra, and body beneath (except the posterior tibiae and tip of last abdominal segment) uniformly brownish yellow.

Oberea montivagans, new species.

Female. — Robust, subcylindrical, uniformly brownish or reddish yellow, except antennae and tips of mandibles, which are black or reddish brown.

Head slightly wider than pronotum, the front broad, feebly convex, slightly transverse, with a longitudinal, median groove or carina extending from epistoma to occiput; surface densely, feebly punctate, with numerous large, inconspicuous punctures intermixed, rather densely clothed with short, inconspicuous, erect pubescence, with numerous long, fine, erect hairs intermixed; eyes rather small; antenna nearly as long as body.

Pronotum slightly wider than long, subequal in width at base and apex; sides parallel, feebly sinuate, feebly constricted near anterior and posterior angles; disk broadly, transversely depressed along base, more deeply, trans-

versely depressed at apical fourth; surface coarsely, irregularly, indistinctly punctate, sparsely clothed with short, erect, inconspicuous pubescence. Scutellum subtriangular, broadly rounded at apex.

Elytra distinctly wider at base than pronotum, extending nearly to apex of abdomen; sides feebly, broadly constricted from near the base to apical sixth, where they are arcuately expanded, then obliquely narrowed to the tips, which are separately obliquely emarginate and bidentate; disk strongly flattened and longitudinally depressed; surface coarsely, seriately punctate basally, becoming finely punctate near apices, sparsely clothed with short, recumbent and long erect, yellowish hairs intermixed; each elytron ornamented along sutural margin in front of middle with an elongate spot of long, recumbent, silky, yellow hairs, which are transversely recumbent.

Body beneath finely, densely granulose, densely, uniformly clothed with short, inconspicuous, recumbent, yellowish pubescence, with a few longer, semi-erect hairs intermixed, the first two abdominal segments densely clothed with long, recumbent, silky, yellow pubescence; last abdominal segment with a narrow, longitudinal, median carina or groove, broadly subtruncate at apex, the surface with a few long, erect, brownish hairs; posterior femora extending to middle of second abdominal segment.

Length, 18 - 19 mm; width, 3 - 3.25 mm.

Type locality. — West Java: Preanger, Mt. Tangkoeban Prahoe.

Described from two females (one type) collected at the type locality, at an altitude of 1400 meters, the type November 28, 1928, and the paratype during March 1934, by F. C. DRESCHER.

The paratype differs from the type in having the pronotum more or less brownish, the antennae uniformly black, the elytra black with the bases brownish, the last four abdominal segments brown, the metasternum, mesosternum, tibiae, and tarsi in part, brownish, and in having the dark areas clothed with brownish pubescence.

This species differs from *erythrostoma* HELLER in having the head only feebly punctate; the pronotum deeply, transversely depressed near the anterior margin; the elytra strongly expanded near apices, deeply, longitudinally depressed on disk, and each elytron ornamented with an elongate spot of silky, yellow pubescence; and in having the first two abdominal segments densely clothed with silky, yellow pubescence.

THE BIRDS OF BILLITON ISLAND

by

F. N. CHASEN

(Director, Raffles Museum, Singapore).

The history of Billiton ornithology has been reviewed by Mr. C. BODEN KLOSS in a previous number of „Treubia" [1]) wherein there is also a sketch map of the island showing its relation to Sumatra and Borneo.

Dr. A. G. VORDERMAN's report (1891) listed ninety-three species from the island. Of these, a visual record of *Ictinaëtus malayensis* needs confirmation in view of the fact that *Spizaëtus cirrhatus limnaeetus*, which in its dark phase is superficially very like *Ictinaëtus*, occurs on the island; furthermore, *Orthotomus sepium ruficeps* LESS. („*cineraceus*" auct., nec BLYTH) is listed under two names, *O. borneonensis* and *O. cineraceus*. To the amended list of ninety-one species KLOSS added *Accipiter virgatus gularis, Halcyon coromanda minor, Hierococcyx fugax nisicolor* (coll., BRAUTIGAM), and *Turdus o. obscurus*. It must also be added that included in a few skins from Billiton in the British Museum (ex. TWEEDDALE *coll.*), are *Rallus fasciatus* and *Ardea s. sumatrana*.

The collection on which the present paper is based was made by Mr. F. J. KUIPER in 1935 - 7 and I am grateful to Dr. K. W. DAMMERMAN for the opportunity of studying such a beautiful series of well-made, well-labelled skins from such an interesting locality.

Mr. KUIPER's collection adds no less than seventy species to the list of Billiton birds making a total of one-hundred and sixty-seven for the island and a few adjacent islets.

Twenty-four of the recent additions are sea-fowl and shore-birds, mostly migratory species.

Charadrius, Squatarola, Numenius, Limosa, Capella, Erolia, Tringa, Glareola, Sterna, Anöus, Demigretta and *Fregata*. The following eleven birds are also migrants. — *Pernis apivorus japonicus, Falco peregrinus calidus, Pandion haliaetus cristatus, Eurystomus orientalis calonyx, Merops superciliosus javanicus, Chalcites basalis, Cuculus m. micropterus, Eudynamys s. scolopaceus, Geokichla sibirica, Matacilla f. simillima* and *Hirundo rustica*. Perhaps the specimens obtained of *Gallicrex, Ixobrychus sinensis, I. eurhythmus, Dupetor, Goisakius, Halcyon pileata* and *Pitta b. cyanoptera* were also migrants, but this is not certain. Purely resident forms added to the list by Mr. KUIPER's efforts number twenty-six from the viewpoint of the faunist they are the most important of all. — *Rallus striatus gularis, Amaurornis phoenicurus javanicus,*

[1]) "Some birds of Billiton Island", XIII, 1931, p. 293.

Dendrocygna j. javanica, Spizaëtus nipalensis alboniger, Spizaëtus cirrhatus limnaeetus, Spilornis cheela natunensis, Haliaceetus leucogaster, Strix l. leptogrammica, Phodilus badius parvus, Batrachostomus javensis, Alcedo atthis bengalensis, Anthracoceros malayanus, Cypsiurus batasiensis infumatus, Micropus affinis subfurcatus, Collocalia francica subsp., *Collocalia esculenta cyanoptila, Hierococcyx f. fugax, Centropus bengalensis javanicus, Rhinomyias o. olivacea, Lalage n. nigra, Pycnonotus simplex perplexus, Malacocincla abbotti eritora, Pachycephala cinerea butaloides, Zosterops chloris solombensis, Leptocoma jugularis microleuca,* and *Munia punctulata fretensis.* Two last additions, *Geopelia s. striata* and *Padda oryzivora* have, perhaps, been introduced into the island as cage birds: both are, usually, very common wherever they occur, and VORDERMAN's large collection contained neither species.

It will be noticed that I have dealt with the collection purely as a systematist and zoogeographer, but the collector could certainly contribute some interesting biological observations, judging from various notes he has made, here and there, on the field-labels and from his published articles [1]). In justice to Mr. KUIPER it should also be added that the greater part of his collection was in my hands before my "Handlist of Malaysian Birds" was published in 1935 and that I inserted many new records for Billiton in the page-proofs of the book based entirely on his skins.

From the collection I have ventured to describe six new subspecies: the status of some other forms is doubtful and there is a possibility that a Billiton subspecies of the following species will have to be separated when better material either of the island form or of the races needed for comparison is available. — *Treron curvirostra, Callolophus miniaceus, Strix leptogrammica, Hypothymus azurea* and *Anaimos thoracicus.*

Two species obtained by VORDERMAN and not represented in the present collection also require re-examination with a view to establishing their subspecies and additional material would therefore serve a very useful purpose: they are *Pycnonotus erythropthalmos* and *Aethostoma rostratum.* Further specimens of *Cyanoderma, Mixornis* und *Collocalia francica* are also needed.

We find that owing to lack of material the exact affinities of four of the one-hundred and sixty-seven Billiton birds are not yet clear and forty are migrants, shore and sea-birds etc. Of the remainder, eighty-two forms are common to Sumatra and Borneo; twenty-three are Sumatran and four Bornean. Three forms are neither Sumatran nor Bornean, but are characteristic of the small islands of the ocean tract separating the Malay Peninsula and Sumatra on the one hand and Borneo on the other; eight forms are peculiar to Billiton itself; two seem like subspecies described from the neighbouring island of Banka and one has spread from other small islands in the Java Sea. Be it noted also that the avifauna of Billiton includes representative of three *species* found in Sumatra and not in Borneo (*Turnix suscitator, Cisticola juncidis,* and *Munia*

[1]) See "De Tropische Natuur", 26, 1937, p. 67 - 68 (*Anous minutus worcesteri,* breeding); *Ibid.*, p. 83 - 84 (*Cypsiurus batasiensis infumatus,* breeding).

punctulata), but only one (*Anaimos thoracicus*) found in Borneo and not in Sumatra. Mr. KUIPER's collection provides us with a far more exact analysis of the Billiton avifauna than has hitherto been possible. It shows that the majority of Billiton forms are common to the lowlands of Sumatra and Western Borneo; that in the minority the Sumatran element is strongly dominant although the Bornean element is not insignificant; and that local differentiation is stronger than was expected. This analysis gives the result to be expected from a glance at KLOSS' sketch map for although Billiton is situated about half-way between Sumatra and Borneo it is embraced by the off-shore 40-metre line of the former island with which the island of Banka also acts as a connecting link whereas to the east of Billiton the map shows intruding depths of 50 metres before the off-shore 40-metre line of Borneo is reached. It is most unfortunate that no detailed comparison can be made between the birds of Billiton and Banka, but no recent material from the latter island is available for study.

In addition to the main island of Billiton the present collection contains material from the following neighbouring islets. — Kamoedi Island, near Cape Kaloempang on the south coast; Langkoeas Island, one of the Elf Islands, just off the north-west point; Kebatoe, or Schoen Island, sixty kilometres south of Billiton; "Witte Rots" (White Rock), just off Kebatoe; Lima Island, about twenty-two kilometres west of Billiton; Keramiah Island, just off the south coast; and Betang Island, just off the west coast of Billiton.

SYSTEMATIC.

The following four subspecies have already been described as peculiar to Billiton: two are from the KUIPER collection (*Chotorea, Pycnonotus*).—

1922 *Malacocincla abbotti eritora* OBERH.

1931 *Eurylaimus javanicus billitonis* KLOSS.

1935 *Chotorea rafflesii billitonis* CHAS.

1935 *Pycnonotus plumosus billitonis* CHAS.

In the following pages four other new forms are diagnosed.—

Turnix suscitator kuiperi subsp. nov.

Phodilus badius parvus subsp. nov.

Chloropsis cochinchinensis billitonis subsp. nov.

Macronus ptilosus sordidus subsp. nov.

PHASIANIDAE.

Rollulus roulroul (SCOP.).

VORDERM., p. 510; KLOSS, p. 293.

3 ♂, 5 ♀. Wings ♂ 139, 139, 140; ♀ 134, 136, 139, 140 mm.

Birds from Sumatra, Borneo and Billiton (*terr. typ.*, Malacca) seem inseparable.

Excalfactoria chinensis palmeri RILEY.

Excalfactoria chinensis, VORDERM., p. 514.

3 ♂, 2 ♀. Wings ♂ 69, 71, 70; ♀ 71, 72 mm.

These are dark birds very near to *lineatus* of the Philippines, but the males have much slaty blue on the upper parts: one specimen has a patch of red in the wings. Birds from Java (*terr. typ.*), South Sumatra, South Borneo and Billiton seem inseparable, but the material examined is not very large.

TURNICIDAE.

Turnix suscitator kuiperi subsp. nov.

Areoturnix plumbipes, VORDERM., p. 513; *T. s. suscitator,* KLOSS, p. 293.

Characters. — Both sexes are much darker on the upper parts than in *T.s. suscitator* (GM.), of Java and Sumatra, and *T.s. atrogularis* (EYTON) of the Malay Peninsula, but nearer to the former subspecies on account of the rufous barring on the upper parts, which in females forms an indistinct collar; the less extensive black area on the throat and breast; and the heavier and more extensive barring on the under parts. The wings and under parts are less buffy than in the other Malaysian races.

Type. — Adult female collected on Billiton Island, 9th February, 1936, by Mr. F. J. KUIPER. Zool. Mus., Buitenzorg, Java. Wing, 90 mm.

Specimens examined. — Fourteen. Wings, ♂ 82, 83, 83, 83, 81, 82, 82; ♀ 85, 89, 89, 86, 89, 90, —, 85, 90 mm, compared with good series from Java and the Malay States.

Remarks. — This is a very distinct race. If the three Malaysian races are laid out in series, the sexes mixed, and the backs uppermost, the typical form gives a colour impression of brownish buff, or fawn colour, much mixed with rufous: *atrogularis* is colder in tone, basically dull, brownish grey and without the rufous markings. The Billiton form appears dark grey mixed with rufous. The old specimen examined by KLOSS and referred to the typical subspecies was much faded.

COLUMBIDAE.

Treron curvirostra curvirostra (GMEL.).

Treron nasica, VORDERM., p. 499; *T. c. curvirostra,* KLOSS, p. 294.

1 ♂. Wing 142 mm.

I have only seen two birds from Billiton, both adult males. One is the fresh skin collected by Mr. KUIPER; the other is the old skin collected and discussed by VORDERMAN and later re-examined by KLOSS: two other specimens from Billiton are in the British Museum. In the present paper, owing to the paucity of the material, I have followed KLOSS and placed Billiton birds with the typical subspecies, but it seems possible that they represent an undescribed race.

The type locality of *T. c. curvirostra* (GMEL.), is the Malay State of Selangor, and Bornean birds, including topotypes of *Columba nasica* SCHLEG., from the south of the island, seem inseparable. A large series of topotypical *curvirostra* gives a wing-range of 127 - 138 mm: a smaller series of birds from the mainland of Borneo gives 121 - 136 mm. The species seems to be less common in Sumatra than in the Malay Peninsula and Borneo: nine birds from the west and south of the island have wings measuring 125 - 137 mm in length. The four Billiton birds have wings measuring 136, 139 (Brit. Mus., *fide* H. C. ROBINSON, MS.), 140, 142 mm: the average size is, therefore, large. Furthermore, the two specimens before me are both very pale on the forehead and the newer skin has the dark bar on the tail narrower than in any other example of *curvirostra* I have seen except the one bird in the British Museum placed by SALVADORI under *T. nasica* in Cat. Birds, Brit. Mus., XII., p. 38. This bird also resembles the Billiton skin in that it is pale on the forehead and large (wing 141 mm). It is said to have been collected by WALLACE in Sumatra, presumably in Palembang on the mainland opposite to Banka and Billiton: it is, however, peculiar in that the sides of the head are more feathered than in *curvirostra*.

Treron fulvicollis fulvicollis (WAGL.).

VORDERM., p. 501; KLOSS, *p.* 294.

1 ♂, 1 ♀. Wing: 150 (*c*), 142 mm.

Birds from Sumatra (*terr. typ.*). South Borneo and Billiton seem inseparable.

Treron vernans griseicapilla SCHLEG.

Treron vernans, VORDERM., p. 501.

4 ♂. Wings —, 145, 145, 148 mm. Also 1 Juv. ♀.

Birds from South Sumatra (*terr. typ.*), most of Borneo, and Billiton seem inseparable: birds from South-east Borneo seem nearer to *T. v. purpurea* of Central and East Java. One of the Billiton males is also very pale on the forehead and throat and could equally well be placed with *purpurea*.

Ducula aenea aenea (LINN.).

Carpophaga aenea, VORDERM., p. 505.

1 ♂, 2 ♀. Wings 229, 223, 226 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Flores).

Myristicivora bicolor bicolor (SCOP.).

Carpophaga bicolor, VORDERM., p. 507.

1 ♂ imm.; 1 ♀ from Kamoedi Island near Cape Kaloempang; 1 ♂ from Billiton. Wings, ♂ 230; ♀ 223 mm.

Birds from Sumatra, Borneo and Billiton are alike (*terr. typ.*, New Guinea).

Geopelia striata striata (LINN.).

1 ♀. Wing 95 mm.

Birds from the Malay Peninsula (*terr. typ.*), Sumatra and Borneo seem inseparable.

Streptopelia chinensis tigrina (TEMM.).

Spilopelia tigrina, VORDERM., p. 508.

1 ♀. Wing 148 mm.

Birds from South Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

Chalcophaps indica indica (LINN.).

VORDERM., p. 508.

2 ♂. Wing —, 140 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Calcutta).

RALLIDAE.

Rallus striatus gularis HORSF.

2 ♂, 2 ♀. Wings ♂ 122, 118; ♀ 113, — mm.

Birds from Sumatra and Billiton seem inseparable from *gularis* of Java which is also probably the form occurring in South Borneo although this is not yet certain as the material examined is poor.

Amaurornis phoenicurus javanicus (HORSF.).

2 ♂, Wings 147, 150 mm.

The resident birds of Sumatra, Borneo and Billiton seem alike (*terr. typ.*, Java).

Gallicrex cinerea plumbea (VIEILL.).

1 ♂. Wing 190 mm.

A bird in brown plumage dated 29th December. Birds from Sumatra, Borneo and Billiton seem alike (*terr. typ.*, Java).

CHARADRIIDAE.

Charadrius apricarius fulvus GMEL.

5 ♂, 2 ♀. Migrants dated from 1st October to 30th November.

Charadrius leschenaultii leschenaultii LESS.

1 ♂, 1 ♀. Migrants dated 10th November; also 2 ♂ from Seriboe Island dated 28th September and 2 ♂, 1 ♀ from Betang Island dated 14th December.

Charadrius mongolus atrifrons WAGL.

1 ♀. A migrant dated 10th November.

Charadrius dubius curonicus GMEL.
2 ♀, Migrants dated 14th - 25th November. Wings, 114 - 5, 113 mm.

Charadrius peronii SCHLEG.
2 ♂, 1 ♀. Wings 97, 98, —, 103 mm.

Birds from the Sumatran Province, Borneo (*terr. typ.*) and Billiton seem alike. A resident species.

Squatarola squatarola australis REICH.
2 ♀, Betang Island. Migrants dated 14th December.

SCOLOPACIDAE.

Numenius arquata orientalis BREHM.
1 ♂, Betang Island. A migrant dated 14th December.

Numenius madagascariensis (LINN.).
1 ex. A migrant dated 10th November.

Numenius phaeopus variegatus (SCOP.).
VORDERM., p. 516.
2 ♂, 3 ♀. Migrants dated from 21st September to 30th April.

Limosa lapponica baueri NAUM.
1 ♀. A migrant dated 27th February.

Capella stenura (BP.).
3 ♀. Migrants dated 6th and 21st March and 26th December.

Erolia testacea (PALL.).
1 ♂. A migrant dated 1st October.

Erolia ruficollis (PALL.).
2 ♂, 1 ♀. Migrants dated from 25th September to 25th November.

Tringa totanus eurhinus (OBERH.).
2 ♀. Migrants dated 29th September and 29th October.

Tringa nebularia (GUNN.).
1 ♂. A migrant dated 30th November.

Tringa hypoleucos (LINN.).
1 ♂, 1 ♀. Migrants dated 20th October and 30th November.

GLAREOLIDAE.

Glareola pratincola maldivarum FORST.

1 ♂. A migrant.

LARIDAE.

Sterna bergii cristata STEPH.

1 ♂. Wing 324 mm (from Langkoeas Island, Elf Islands, just off the north-west point of Billiton).

Sterna bengalensis bengalensis LESS.

1 ♂, 2 ♀. Wings ♂ 295; ♀, —,— mm 18th January. The females are from Betang Island.

It is curious that this tern has not yet been recorded from Borneo, although it seems certain that it must occur, at least along the south coast.

Sterna anaethetus anaethetus SCOP.

1 ♂, 1 ♀. Wings 256, 265 mm (from Langkoeas Island, Elf Islands, just off north-west point of Billiton, 24th July, and "Witte Rots (White Rock), near Kebatoe I., 60 km south of Billiton, 13th July). Widely spread in the Malaysian subregion.

Sterna sumatrana sumatrana RAFFLES.

2 ♂. Wings 233, 217 mm (from Langkoeas Island, Elf Islands, just off north-west point of Billiton, 24th July). Widely spread in Malaysian seas.

Anoüs minutus worcesteri (MC GREG.).

1 ♂, 1 ♀. Wings, 222, 220; tail, 121, 119, tarsus, 21, 21, exposed culmen, 42, 40; bill from gape. 56, 54; middle toe and claw, 37, 37 mm. "Witte Rots" (White Rock), quite near Kebatoe (Schoen Island), about 60 kilometres south of Billiton, 5th June and 13th July). In Malaysia this species, which is easily confused with the much commoner *Anoüs stolidus* but recognized by the much slenderer bill, is only known from the Straits of Malacca, the coast of Sarawak, and the small islands near Billiton. The subspecies *worcesteri* was described from Cavilli Island in the Sulu Sea. The measurements of the present specimens agree very closely with those of the type of *worcesteri,* but no direct comparison has been possible.

Anoüs stolidus pileatus (SCOP.).

1 ♂, Wing, 282 mm (from Kebatoe (or Schoen Island), about 60 kilometres south of Billiton, 5th June).

CICONIIDAE.

Leptoptilos javanicus (Horsf.).

1 ♀. Wing, about 560 mm.

ARDEIDAE.

Demigretta sacra sacra (Gmel.).

3 ♀. Wings 262, 246 (imm.), 261 mm.

One specimen in the white and two in the dark phase. One of the latter is from Lima Island about 21 kilometres west of Billiton: the other is an immature bird.

Widely spread in the same form throughout Malaysia.

Goisakius melanolophus melanolophus (Raffles).

2 ♀. Wings 252, 259 mm.

Found in the same form in Sumatra (*terr. typ.*), Borneo and Billiton.

Butorides striatus javanicus (Horsf.).

Vorderm., p. 517.

1 ♂, 3 ♀. Wings ♂, 170; ♀ 167, 167, 178 mm.

The resident birds of Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

Ixobrychus sinensis sinensis (Gmel.).

1 ♀. Wing 129 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, China).

Ixobrychus eurhythmus (Swinh.).

2 ♂, 1 ♀. Wings 149, 144, 140 mm. 10th January, 5th March, 30th April.

This bird is probably only a migrant to Malaysia where it also occurs in Sumatra and Borneo (*terr. typ.*, South China).

Dupetor flavicollis flavicollis (Lath.).

1 ♂. Wing 190 mm. Birds from Borneo, Sumatra and Billiton seem alike (*terr. typ.*, India). Perhaps a migrant (1st January).

FREGATIDAE.

Fregata andrewsi Math.

Fregata aquila, Vorderm., p. 518.

1 imm. ♀ (from Langkoeas Island, Elf Islands, just off the north-west point of Billiton, 28th July). This species has not yet been recorded from the Straits of Malacca, or from the west coast of Sumatra.

Fregata ariel ariel (G. R. GRAY).

2 ♀. Wings 542, 549 mm (from Langkoeas Island, Elf Islands, just off the north-west point of Billiton, 9th October). An adult and an immature bird. The species is widely spread in Malaysian seas.

ANATIDAE.

Dendrocygna javanica javanica (HORSF.).

2 ♂. Wings, 186, 188 mm. Birds from Sumatra, Borneo and Billiton seem alike (*terr. typ.*, Java).

FALCONIDAE.

Accipiter virgatus gularis (TEMM. and SCHLEG.).

KLOSS, p. 294.

2 ♂, 4 ♀. Wings ♂ 170 (ad.), 167; ♀ 191, 188, 190, 195 mm.

The skins are dated from 22nd October to 17th April (adult).

Spizaëtus cirrhatus limnaeetus HORSF.

1 ♂, 1 ♀. Wing 378, 408 mm.

Birds from Sumatra, Borneo and Billiton seen inseparable (*terr. typ.*, Java).

Spizaëtus nipalensis alboniger (BLYTH).

1 ♂. Wing 289, tail, 217; bill from gape, 33 mm; 1 ♀. Wing 312; tail, 229; bill from gape, 35 mm.

These birds are both very small and it would be interesting to examine adults from Billiton. They are in the plumage usually described as the second, or intermediate stage, that is the plumage succeeding the immature phase and preceding the black and white of the perfect dress. The male has the top of the head, largely black; upper parts, dark brown, darkest on the shoulders and mantle. Sides of head and nape, mostly tawny-buff. Chin, white with a black median stripe; breast and abdomen, tawny-buff, heavily streaked on the breast with black and indistinctly barred with dark brown and white on the abdomen. Lower abdomen, under tail coverts, thighs and tarsi, white, regularly barred with blackish. Tail with three, visible, dark bars. Crest narrow, about 50 mm in length, and black narrowly tipped with white. The feathering of the feet extends to a point half way along the basal joint of the middle toe.

Birds from Sumatra and Borneo seem alike: the Javan race (*bartelsi*) seems never to attain the black and white plumage seen in old birds of *alboniger*.

Spilornis cheela natunensis CHAS.

Spilornis cheela natunensis CHASEN, Bull. Raff. Mus., IX, 1934, p. 93. (Bunguran Island, North Natuna Islands).

3 ♂, 1 ♀, 1 ex. Wings ♂ 311, 312, 312; ♀ 308; sex? 304 mm.

This very plastic serpent-eagle has developed subspecies on almost all the

Malaysian islands, large and small, on which it is found and it is no surprise to find that the Billiton race is neither the Sumatran nor the Bornean subspecies. I cannot, however, separate the small Billiton series from three topotypes of *natunensis:* all specimens from the two localities are comparatively small and grey.

Haliaeetus leucogaster (GMEL.).

1 imm. ex. Wing 545 mm; 1 ♂, Wing 538 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.,* Java).

Haliastur indus intermedius GURNEY.

1 ♂. Wing 391 mm.

Pernis apivorus japonicus KURODA.

1 ♂. Wing 446 mm.

A migrant dated 23rd January.

Falco peregrinus calidus LATH.

1 ♀. Wing 314 mm.

An immature migrant dated 28th March and, if correctly sexed, very small.

PANDIONIDAE.

Pandion haliaetus cristatus (VIEILL.).

1 ♂. Wing 395 mm.

A migrant from Lima Island about 21 kilometres west of Billiton.

STRIGIDAE.

Bubo ketupu ketupu (HORSF.).

Ketupa javanensis, VORDERM., p. 418.

1 ♂. Wing 327 mm; 1 juv. ♀, 7th October.

Birds from Sumatra, West Borneo and Billiton seem inseparable (*terr. typ.,* Java).

Strix leptogrammica leptogrammica TEMM.

2 ♂, 2 ♀; 1 nestling. Wings ♂ 314, 303; ♀ 294, 310 mm.

It is possible that these beautifully prepared skins represent an undescribed race peculiar to Billiton. They are very richly coloured and have broad, conspicuous, bright reddish orange nuchal collars: they stand much closer to typical *leptogrammica* of Borneo, as represented by specimens from Sarawak, than to the duller *S. l. myrtha* of Sumatra. Unfortunately, I have seen very few skins of true *leptogrammica:* two specimens from British North Borneo are less rufous in general tone and whiter, less buffy, on the bellies than three rather old skins from Sarawak. The Billiton birds have darker caps and are

even more rufous than the Sarawak examples, but this owl is so variable wherever it is found that pending examination of better topotypical material I attempt no further separation. The nestling, dated 15th June, is mostly in down but with the quills half-grown. The down is pale rufous-buff in colour.

Phodilus badius parvus subsp. nov.

Like *P. b. badius* (HORSF.) of Java, but smaller. Wings 172 - 180 against 180 - 196 mm in topotypes from Java.

Type. — Adult female, collected on Billiton Island, on 5th November, 1935 by F. J. KUIPER. Zool. Mus., Buitenzorg, Java.

Specimens examined. — Eight, including the type. Wings ♂ 171; ♀ 172, 176 (type) 175, 179, 180, 180 mm.

Remarks. — The late H. C. ROBINSON commented on the small size of a Billiton example of this owl in Bull. Brit. Orn. Club, xlvii, 1927, p. 121. The specimens in the Raffles Museum add little to the measurements of series from various localities given by this author except to run up the wing-range of Bornean birds to 193 mm. I can also supply measurements for a few recently acquired Sumatran birds. — 3 ♂, 182 - 190; 1 ♀ 197 mm, and Dr. MAX BARTELS has very kindly given me the following measurements of the Javan birds in his collection. — ♂ 180, 181, 185, 186, 186, 188, 190; ♀ 180, 182, 184, 184, 185, 186, 191, 191, 192, 196 mm. The small feet and short bills of the Billiton birds also stand out when series are compared. Birds from Sumatra and Borneo seem inseparable.

PSITTACIDAE.

Psittacula longicauda defontainei CHAS.

Palaeornis longicauda, VORDERM., p. 418; KLOSS, p. 294.

5 ♂, 1 ♀. Wings ♂ —, 162, 155, 164, 165; ♀ — mm.

Billiton birds run large and are best placed with *defontainei* (*terr. typ.*, Bunguran, North Natuna Islands), which is found on the small islands of the ocean tract separating the Malay Peninsula, Sumatra and Borneo on the one hand and Borneo on the other. Birds from Sumatra and Borneo seem inseparable.

Loriculus galgulus galgulus (LINN.).

VORDERM., p. 421.

6 ♂. Wings 85, 82, 82, 83, 88, 85 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Malacca).

PODARGIDAE.

Batrachostomus javensis (HORSF.).

1 ♂, 1 ♀. Wings 132, 129 mm; 1 juv. 2nd May.

The nestling, which is referred to this species purely by association, is in an advanced coat of down with less than half-grown wings and tail of teleop-

tiles. The upper parts are pale brown, faintly rufous; the under parts are whitish: both upper and under parts are barred with dusky. The lores and supercilia are broadly white and there is a white patch on the scapulars. I have referred these Billiton specimens to the species usually known as *javensis,* but I am now not certain that the name has been rightly applied in the case of non-Javan specimens.

CORACIIDAE.

Eurystomus orientalis orientalis (LINN.).

VORDERM., p. 441, KLOSS, p. 294.

1 ♂. Wing —.

An example of the resident race dated 29th April. Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.,* Java).

Eurystomus orientalis calonyx SHARPE.

1 ♂. Wing 182 mm.

A brightly coloured example of the migratory race dated 29th April.

ALCEDINIDAE.

Ramphalcyon capensis cyanopteryx OBERH.

Pelargopsis leucocephala, VORDERM., p. 436.

3 ♀. Wing 140, 149, 150 mm.

The Sumatran, not the Bornean, subspecies.

Ceyx rufidorsus STRICKL.

Ceyx innominata, VORDERM., p. 436.

2 ♂, 1 ♀, 1 ex. Wings ♂ 57, 55; ♀ 55; sex? 53 (imm.) mm. The collection also includes two juveniles dated 6th April.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.,* Malacca).

Alcedo meninting verrauxii DE LA BERGE.

VORDERM., p. 434.

1 ♂, 2 ♀. Wings 62, 63, 64 mm; 1 ex. 63 mm: 1 imm.

Birds from Borneo (*terr. typ.*), Sumatra and Billiton seem inseparable.

Alcedo atthis bengalensis (GMEL.).

1 ex. Pulau Seriboe; 1 ♀ Billiton. Wings, 72, 72 mm. Birds from Sumatra, Borneo and Billiton seem alike (*terr. typ.,* Bengal).

Halcyon coromanda minor TEMM. and SCHLEG.

KLOSS, p. 294.

1 ♂, Wing 100 mm.

Birds from South Sumatra, Borneo and Billiton seem inseparable (*terr. typ.,* Malacca).

Halcyon sancta sancta VIG. and HORSF.
Sauropatis sancta, VORDERM., p. 440.
2 ♂, 1 ♀. Wings —, 88, 95 mm.
Migıants dated 2nd June and 23rd August.

Halcyon chloris cyanescens (OBERH.).
Sauropatis chloris, VORDERM., p. 439.
1 ♂, 2 ♀. Wings 112, 117, 113 mm.
Birds from South Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Taya Island, South-east Sumatra).

Halcyon concreta concreta (TEMM.).
Caridagrus concretus, VORDERM., p. 437; *Halcyon c, concreta*, KLOSS, p. 294.
1 ♂, 2 ♀. Wings ♂ 107; ♀ 113, 112 (*c*) mm.
The Sumatra and Bornean races are very much alike, but the latter is slightly larger. On the available scanty material (KLOSS records a male with a wing-length of 110 mm) Billiton birds are best placed with the typical (Sumatran) form.

Halcyon pileata (BODD.).
1 ♂, 29th October. Wing 130 mm.
Birds from Sumatra, Borneo and Billiton seem alike (*terr. typ.*, China).

BUCEROTIDAE.

Anthracoceros malayanus (RAFFLES).
1 ♂. Wing 327 mm; bill from gape, 143 (*c*); length of casque (straight), 145 mm. Casque and superciliary stripes, white. The collection also includes two immature birds, one of each sex. In both, the casque and superciliary stripes are white. Birds from Sumatra (*terr. typ.*), Borneo and Billiton seem inseparable.

MEROPIDAE.

Merops viridis viridis LINN.
Merops bicolour, VORDERM., p. 434.
4 ♂, 1 ♀. Wings ♂ 115, 111, 110 ,—; ♀ 107 mm.
Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

Merops superciliosus javanicus HORSF.
2 ♀. Wings 126, 126 mm. Migrants dated 18th February.

CAPRIMULGIDAE.

Caprimulgus concretus concretus BP.
VORDERM., p. 448.
3 ♂, 3 ♀. Wings ♂ 162, 164, 164; ♀ 166, 161, 165 mm.
Birds from Sumatra, Borneo (*terr. typ.*) and Billiton seem inseparable.

Caprimulgus affinis affinis Horsf.

Vorderm., p. 448.

2 ♂, 2 ♀. Wings 165, 165; ♀ 158, 159 mm.

Birds from Sumatra, Billiton and Borneo seem inseparable (*terr. typ.*, Java).

MICROPODIDAE.

Hemiprocne longipennis harterti Stres.

Dendrochelidon longipennis, Vorderm., p. 450.

3 ♂, 2 ♀, 1 juv. (30th July). Wings ♂ 152, —, 158; ♀ 162, 157 mm. Birds from Sumatra (*terr. typ.*), Borneo and Billiton seem inseparable.

Cypsiurus batasiensis infumatus (Sclat.).

2 ♀. Wings 111, 115 mm.

Birds from Sumatra, Borneo (*terr. typ.*) and Billiton seem inseparable.

Micropus affinis subfurcatus (Blyth).

1 ♂, 4 ♀. Wings ♂ 138; ♀ 138, 142, 139, 132 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Penang).

Collocalia esculenta cyanoptila Oberh.

7 ♂, 3 ♀, 4 ex.; 3 ♂, 1 ♀, young birds. Wings ♂, 102, 103, 106, 99, 105, 103, 102; ♀, 102, 105, 107; unsexed, 104, 104, 102 mm.

One adult has a large white patch on the breast. (I have seen examples of *Collocalia vestita maratua* and *C. francica germani* in which the blackish body plumage is much mixed with white). Birds from East Sumatra, Borneo and Billiton seem alike.

Collocalia vestita vestita (Less.).

?*Collocalia fuciphaga*, Vorderm., p. 450.

1 ♂, Wing 112 mm.

C. v. vestita occurs also in Sumatra. The Bornean form is very slightly different.

Collocalia francica subsp.

Three half-grown juveniles appear to represent a form of this species but unfortunately the collection contains no adult bird. The rump is very distinctly lighter than the back and there are a few small feathers on the tarsi. No form of *C. francica* has yet been recorded from Sumatra but two forms are known from the coastal islands of Borneo.

TROGONIDAE.

Harpactes duvaucelii (Temm.).

Pyrotrogon duvaucelli, Vorderm., p. 421.

5 ♂, 3 ♀. Wings ♂ 103, 105, 106, 108, 109; ♀ 107, 109, 109 mm.

Birds from Sumatra (*terr. typ.*), Borneo and Billiton seem inseparable.

CUCULIDAE.

Chalcites basalis (HORSF.).

2 ♀. Wings 98, 102 mm.

Migrants dated 2nd and 4th June.

Cuculus micropterus micropterus GOULD.

1 ♂. Wing 216 mm. A very large example dated 25th February: probably a migrant.

Hierococcyx fugax fugax (HORSF.).

1 juv. ♀ (12th July).

The resident birds of Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

Eudynamys scolopaceus scolopaceus (LINN.).

1 ♀. Wing 198 mm.

A migrant dated 23rd January. For the moment I regard all whitish females of this species found in Malaysia as belonging to the typical race (Bengal), but some are large and perhaps referable to *chinensis*. The species needs further revision.

Centropus bengalensis javanicus (DUM.).

5 ♀. Wings 158, 152, 157, 163, 152 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

Rhopodytes sumatranus (RAFFLES).

VORDERM., p. 432; KLOSS, p. 294.

2 ♂, 2 ♀, 1 ex. Wings ♂, 145, 147: ♀ 143, 142; 140 mm.

Birds from Sumatra (*terr. typ.*), Borneo and Billiton seem inseparable.

CAPITONIDAE.

Chotorea rafflesii billitonis CHAS.

Chotorea versicolor, VORDERM., p. 423; *C. rafflesi* subsp., KLOSS, p. 295.

Chotorea rafflesii billitonis CHASEN, Ornith. Monatsber., xliii, 1935, p. 149 (Billiton Island).

5 ♂, 2 ♀. Wings 127, 127, 120, 124, 123; ♀ 125, 120 mm.

This race is nearest to *C. r. borneensis* BLAS., of Sarawak, but it is larger, the wings of seven specimens measuring 120 - 127 mm (average, 123.7 mm) against 110 - 120 mm (average, 116 mm) in sixteen examples of *borneensis*. In both these forms the blue on the head averages slightly paler than in typical *rafflesii* of Sumatra.

PICIDAE.

Callolophus miniaceus malaccensis (LATH.).

Callolophus malaccensis, VORDERM., p. 425.

2 ♂, 3 ♀. Wings ♂ 135, —; ♀ 130, 130, 130 mm.

These birds differ from *C. miniaceus malaccensis* of the Malay Peninsula (*terr. typ.*) and Sumatra and the smaller *C. m. dayak* of West Borneo in the paler chestnut colour of the throat and breast, but in all the specimens the plumage is rather worn and I am not certain that the difference is racial.

With a wing range of 130 - 135 mm for four birds it seems likely that the Billiton bird will prove to be even larger than *malaccensis* of which a large series in the Raffles Museum has the wings measuring 123 - 132 mm with the maximum measurement rare. It is possible that more material would justify the separation of a Billiton subspecies. *C. m. malaccensis* also occurs in North-west Borneo.

Dryobates moluccensis moluccensis (GMEL.).

Iyngipicus fusco-albidus, VORDERM., p. 425.

5 ♀. Wings 74, 77, 79, 78, 77 mm.

One bird is abnormal in that on each wing it has a white patch on the inner greater secondary coverts, larger on one side than on the other.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.,* Malacca).

Meiglyptes tukki tukki (LESS.).

VORDERM., p. 427; KLOSS, p. 295.

2 ♂, 1 ♀. Wings 98, 95; 94 mm.

Birds from Sumatra (*terr. typ.*), Borneo and Billiton seem inseparable.

Micropternus brachyurus badius (RAFFLES).

VORDERM., p. 429; KLOSS, p. 295.

1 ♂, 3 ♀. Wings ♂ 112; ♀ 113, 114, 110 mm.

Billiton birds belong to the Sumatran form and not to the brighter Bornean race (*badiosus*).

EURYLAIMIDAE.

Eurylaimus javanicus billitonis KLOSS.

Eurylaimus javanicus, VORDERM., p. 441.

Eurylaimus javanicus billitonis KLOSS, Treubia, XIII, 1931, p. 295 (Billiton Island).

5 ♂, 3 ♀. Wings ♂ 104, 105, 106, 105, 104; ♀ 108, 103, 105 mm.

Both sexes are very slightly pinker and less leaden on the under parts, especially on the throat, than *E. j. harterti* of Sumatra.

The Billiton race is intermediate between the Sumatran and Bornean (*brookei*) forms, but more closely resembles the former: in a very large series one or two skins from Sumatra are exactly like Billiton birds.

Eurylaimus ochromalus ochromalus RAFFLES.

VORDERM., p. 444; KLOSS, p. 295.

2 ♂, 5 ♀. Wings ♂ 79, 78; ♀ 78, 76, 75, 11, 80 mm.

The Sumatran and Bornean subspecies only differ in the slightly larger average size of the latter: specimens from Billiton agree with the former race (*terr. typ.*, Singapore).

Cymbirhynchus macrorhynchos malaccensis SALVAD.

VORDERM., p. 445.

2 ♂, 5 ♀. Wings ♂ 79, 78; ♀ 78, 76, 75, 77, 80 mm.

One male dated 8th June is a juvenile. Birds from East and South Sumatra and Billiton agree with Malayan topotypes of *malaccensis* in having more white in the tail than is usual in the Bornean (typical) race. All the present examples have white patches on the inner webs of the outer three, four, or five pairs of tail feathers. The Billiton skins are peculiar in that the yellow wash on the axillaries and wing-lining is stronger than in specimens of this species from elsewhere, but, at the moment, I am uncertain as to how much this character is affected by rapid, post-mortem fading.

PITTIDAE.

Pitta sordida bangkana SCHLEG.

Pitta cucullata, VORDERM., p. 488.

5 ♂, 1 ♀, 3 juv. (28th May, 15th August). Wings ♂ 106, 106, 108, 105, 109; ♀ 100 mm.

These specimens are of particular interest because they establish, quite clearly, the status of *bangkana* as a valid, resident, race on Billiton.

Although *P. s. cucullata* may breed in the northern part of the Malay Peninsula it is, I think, only a visitor to the southern parts of its Malaysian range where, in season, it is found in the territory of the resident form, *P. s. mülleri* (authentic specimens of both *cucullata* and *mülleri* have recently been examined from Palembang in Sumatra). Further division of *mülleri* into yet other subspecies seems to me unjustifiable and the report of its occurrence on Banka needs confirmation. Furthermore, I find on investigation, that there is some doubt about the exact provenance of the old specimen of *bangkana* recorded from "Palembang" (Treubia, XIII, 1931, p. 331).

In *cucullata* the crown is usually chestnut, but there is often a dark median stripe: in *mülleri* the entire head is black. The six adult birds from Billiton are very variable in the colour of the crown. Three are indistinguishable in pattern from those *cucullata* with a dark coronal stripe, but the chestnut ground colour is darker: a third example has the crown much mixed with black, but in general appearance it is still nearer to *cucullata* than *mülleri;* the remaining two skins have the crown more black than brown and are nearer to *mülleri* than to *cucullata*.

Pitta brachyura cyanoptera TEMM.

1 ♀, 23rd October. Wing, 125 mm.

Birds ocurring in Sumatra (*terr. typ.*), Borneo and Billiton seem alike.

HIRUNDINIDAE.

Hirundo rustica gutturalis SCOP.

1 ♀. Wing 116 mm (imm.). A migrant dated 14th January.

Hirundo tahitica abbotti (OBERH.).

Hirundo javanica, VORDERM., p. 451.

1 ♀. Wing 103 mm.

Birds from East Sumatra, Borneo and Billiton seem inseparable (*terr. typ.,* Anamba Islands).

MUSCICAPIDAE.

Hypothymis azurea prophata OBERH.

VORDERM., p. 452.

3 ♂, 1 ♀. Wings ♂ 67, 67, 67 mm.

In one male the black gorget is less pronounced than in most males of *prophata:* the other two birds are immature. The female is slightly bluer on the tail than is usual in *prophata:* there is a suggestion therefore that the Billiton bird is verging towards *H. a. karamatensis* of the Karimata Islands, West Borneo and it would be interesting to examine more material from Billiton.

H. a. prophata is found in both Sumatra and Borneo (*terr. typ.,* Karimon Islands).

Rhipidura javanica longicauda WALL.

Leucocerca javanica, VORDERM., p. 452.

3 ♂. Wings 80, 80, — mm. 1 ex. imm.

Birds from Sumatra (*terr. typ.*), Borneo and Billiton seem inseparable.

Terpsiphone paradisi australis CHAS.

Terpsiphone affinis, VORDERM., p. 453.

3 ♂, 1 ♀. Wings ♂ 94, 93, 93; ♀ 97 mm.

The males are in the white phase but one is without streamers: the others in the possession of relatively long tails measuring 350 and 360 mm resemble the Bornean race *T. p. borneensis,* but although their bills can be matched in a long series of *borneensis* they are shorter and narrower than is usual in that race.

Judging from its dull crown the female is not adult. On the upper parts it is so dull that it needs no comparison with *indochinensis* or *affinis,* but it can be exactly matched by some *borneensis* from which, however, it differs in having no buff wash on the under parts and again in having a smaller bill

than the majority of females of that race. It is paler on the back than a female from West Java, but taken together the range of colour shewn by the two birds is still not quite so great as that shewn by series of *borneensis*.

T. p. australis is now known from the Lampongs in South Sumatra, Billiton Island, and West Java: it may be reasonably expected to occur in the extreme south of Borneo.

Rhinomyias olivacea olivacea (HUME).

1 ♂ imm.

This specimen is too young for subspecific examination, but it no doubt belongs to the typical race which is found in Sumatra and Borneo (*terr. typ.*, Tenasserim).

CAMPEPHAGIDAE.

Lalage nigra nigra (FORST.).

1 ♂. Wing 86 mm.

This race is also found in Sumatra (*terr. typ.*, Singapore): the Bornean form is separable (*schisticeps*).

Pericrocotus igneus igneus BLYTH.

Pericrocotus ardens, VORDERM., p. 456; KLOSS, p. 296.

5 ♂. Wings 71, 73, 73, 73, 73; 1 ♂ ?, wing, 70 mm.

The two smallest of these birds are exactly like adult females of this species from other localities, but in one case the field-label bears a drawing of two very small testes and the bird is marked as a male by the collector: the other bird is marked as a male with a query. The specimens in this collection have been so carefully sexed by the collector that I cannot suggest that he is wrong in this particular case.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Malacca).

In my "Handlist of Malaysian Birds" (1935) I included *Pericrocotus flammeus xanthogaster* in the avifauna of Billiton on the strength of VORDERMAN's record of *"P. ardens"*, but although *ardens* is properly a synonym of *xanthogaster*, KLOSS has shewn that VORDERMAN's bird is really *P. igneus. P. f. xanthogaster* must therefore be expunged from the Billiton list.

PYCNONOTIDAE.

Aegithina viridissima viridissima (BP.).

Iora viridissima, VORDERM., p. 470; KLOSS, p. 296.

7 ♂, 1 ♀. Wings ♂ 58, 58, 59, 60, 60, 61, 62; ♀ 63 mm.

Three of the birds sexed by the collector as males are exactly like the female in plumage. Although full-grown they are, no doubt, immature.

Chloropsis cochinchinensis billitonis subsp. nov.

Phyllornis icterocephala, VORDERM., p. 473; KLOSS, p. 296.

Male like *C. cochinchinensis icterocephala* LESS., of Sumatra and the Malay Peninsula, but the golden wash on the nape less extensive and intense, and the posterior part of the crown olivaceus, not yellow, or golden. Adult female rather less golden on the nape than the female of *icterocephala*.

Type. — Adult male collected on Billiton Island, on 24th December 1935 by F. J. KUIPER. Zool. Mus., Buitenzorg, Java. Wing, 80 mm.

Specimens examined. — Five males, two adult females, and three immature birds, compared with very large series of *C. c. icterocephala*. Wings. — ♂ 80, 81, 82, 83, 83; ♀ 77, 78; imm. 75, 75, 80 mm.

Remarks. — In plumage this new subspecies stands between *icterocephala* of Sumatra and *viridinucha* SHARPE, of Borneo in which latter form the hinder part of the crown is grass-green and there is no golden wash on the nape. In the majority of fully adult males of *icterocephala* the yellow of the forehead passes into the golden colour just behind a line drawn between the eyes and there is rarely any green on the crown. Two in more than fifty skins of *icterocephala* are like *billitonis*. Males of *icterocephala* have a wing-range of 78 to 86 mm, but the average is high, 84 mm: the Billiton birds with a wing-range of 80 to 83 mm are, therefore, on the small side.

Chloropsis sonnerati zosterops VIG.

Phyllornis sonneratii, VORDERM., p. 472; KLOSS, p. 296.

1 ♀. Wing 89 mm.

The bill is very small, but the specimen is immature. Birds from Sumatra (*terr. typ.*), Borneo and Billiton seem inseparable.

Irena puella criniger SHARPE.

Irene cyanea, VORDERM., p. 458.

4 ♂, 1 ♀. Wings ♂ 122, 121, 121, 123; ♀ 118 mm.

Birds from Sumatra, Borneo (*terr. typ.*), and Billiton seem inseparable.

Iole olivacea olivacea BLYTH.

VORDERM., p. 477.

1 ♂, 1 ♀. Wings 89, — mm.

Birds from Sumatra and Billiton seem inseparable (*terr. typ.*, Singapore): the Bornean form is separable (*charlottae*).

Brachypodius atriceps atriceps (TEMM.).

Brachipodius melanocephalus, VORDERM., p. 479.

5 ♂, 1 ♀. Wings ♂ 78, 77, 75, 75, 78; ♀ 77 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

Alophoixus phaeocephalus phaeocephalus (HARTL.).

Criniger phaeocephalus, VORDERM., p. 480; KLOSS, p. 296.

1 ♀. The tail is missing and the wings are moulting: a detailed examination

is, therefore, not possible and I follow KLOSS who identified an old skin collected by VORDERMAN as *A. p. phaeocephalus* which occurs in Sumatra, but not in Borneo.

Pycnonotus goiavier personatus (HUME).

Pycnonotus analis, VORDERM., p. 475.

1 ♂, 1 ♀. Wings 80, 81 mm.

Birds from Sumatra (*terr. typ.*), and Billiton seem alike: those from Borneo are very slightly different (*gourdini*).

Pycnonotus plumosus billitonis CHAS.

Pycnonotus plumosus, VORDERM., p. 475; *P. plumosus* subsp., KLOSS, p. 296.

Pycnonotus plumosus billitonis CHASEN, Ornith. Monatsber., 1935, p. 148: Billiton Island.

3 ♂, 1 ♀. Wings ♂ 83, 83, 86 (type); ♀ 80 mm.

In this race the under parts are rather paler and greyer than in the typical form and the brown wash on the sides of the breast and abdomen is reduced. The under tail coverts are bright as in *P. p. plumosus* and not dull as in *P. p. insularis* of Borneo. Two of the four skins examined have the ear coverts paler than in any example in long series of the two above mentioned races. According to the collector the irides of the Billiton race are red.

Pycnonotus simplex perplexus CHAS. and KLOSS.

Pycnonotus simplex perplexus CHASEN and KLOSS, Jour. f. Orn., 1929, Bd. 2, p. 116: Balambangan Island, North Borneo.

6 ♂, 3 ♀, 1 ex. Wings ♂ 82, 83, 85, 77, 76; ♀ 75, 75, 79 mm; sex? 80 mm.

On seven of these specimens the collector has marked the irides as "red"; on one, "red-brown"; and on two, "yellowish white". Of these last mentioned birds one is little more than a juvenile: the other bird I am not quite sure about, but I think it is immature.

P. s. perplexus which occurs in Borneo only differs from the typical race found in Sumatra in having red instead of white irides in the adult.

TIMALIIDAE.

Pellorneum capistratus nigrocapitatum (EYTON).

Drymocataphus nigricapittatus, VORDERM., p. 485; *P. capistratum nigrocapitatum* KLOSS, p. 296.

1 ♂, 1 ♀. Wings 68, 69 mm. 1 juv. dated 11th June.

These birds seem absolutely inseparable from *nigrocapitatum* of the Malay Peninsula from which the Bornean races (*capistratoides* and *morrelli*) are quite distinct. The Banka bird has been named *nyctilampe* OBERH.: I have never seen topotypes of this race and although in a previous publication I used the name for Sumatran birds on the strength of one or two comparatively dark skins examined from that island, I now doubt if a Sumatran race is really separable.

Malacocincla abbotti eritora OBERH.

Malacocincla abbotti eritora OBERHOLSER, Smiths. Misc. Coll. lxxiv, 2, 1922, p. 11 (Billiton Island).

1 ♂. Wing —.

This dull coloured bird needs no comparison with the more brightly coloured race found in Sumatra (*olivaceus*), but judging from the very limited material at my disposal it is extremely close to *M. a. büttikoferi* of Borneo. Compared with an example of *büttikoferi* the Billiton skin has a smaller bill (measured from the gape, 21.7 against 24 mm); the tail is more rufous (a character probably depending on the age of the feathers); the lores and supercilium are slightly greyer and less whitish; and the under parts are, perhaps, very slightly whiter.

Anuropsis malaccensis saturata ROB. and KLOSS.

Brachypteryx malaccensis, VORDERM., p. 487; *A. malaccensis* subsp., KLOSS, p. 297.

Anuropsis malaccensis saturata ROBINSON and KLOSS, Bull. Brit. Orn. Club, xl, 1920, p. 68 (Baram, Sarawak).

4 ♂. Wing 66, 66, 67, 67 mm.

These skins are exactly like some topotypes of *saturata* from Sarawak which also occurs in West Borneo. Sumatra is inhabited by the much duller typical race. A subspecies has been named from Banka (*docima* OBERH.), but no specimens are available for comparison.

Cyanoderma erythroptera apega OBERH.

Cyanoderma erythroptera VORDERM., p. 483; *C. e. (?) apega*, KLOSS, p. 297.

Cyanoderma erythroptera apega OBERHOLZER, Smiths. Misc. Coll., lxxiv, 1922, p. 8 (Banka Island).

1 ♂. Wing 58 mm.

Because of its bright upper parts this specimen agrees more closely with the Bornean than the Sumatran race. In detail it agrees precisely with the description given for the Banka form which seems to be a well-marked race.

Mixornis gularis? ruficoma OBERH.

Mixornis gularis, VORDERM., p. 481.

Mixornis bornensis ruficoma OBERHOLSER, Smiths. Misc. Coll., lxxiv, 1922, p. 6 (Banka Island).

2 ♂. Wings 64, 65 mm.

These two skins are so dissimilar that taken together it is difficult to compare them with neighbouring races of the species although they clearly belong to the *bornensis* group of subspecies and not to the *gularis* section which inhabits Sumatra.

One bird is not unlike typical *bornensis:* it has the under parts very heavily streaked and the upper parts rufous-brown, with the crown only very slightly more richly coloured than the mantle. It differs from *bornensis* in

having no yellow wash on the abdomen. The other bird has the under parts much more lightly streaked and washed with yellow on the abdomen: the upper parts are paler than in the first specimen with a more richly coloured crown fairly sharply defined. As this latter bird agrees with the description given for the Banka race the Billiton birds are tentatively referred to it, but it is evident that more material is required before any sound conclusion can be reached.

Macronus ptilosus sordidus subsp. nov.

Intermediate in characters between the typical race of Malacca, which also inhabits Sumatra, and *M. p. reclusus* HART. of Borneo.

It resembles the former in the comparatively dark chestnut colour of the crown and the latter in the absence of a grey patch on the abdomen. It differs from both races in the paler, less orange washed under parts, the absence of colour being particularly noticeable on the breast.

Type. — Adult female collected on Billiton Island, 26th January 1937 by F. J. KUIPER, Zool. Mus., Buitenzorg, Java. Wing, 68 mm.

Specimens examined. — Three females compared with large series of the two related races. Wings. — ♀, 68, 68, 69 mm.

TURDIDAE.

Copsychus saularis musicus (RAFFLES).

Copsychus mindanensis, VORDERM., p. 497.

1 ♂. Wing 101 mm. Also one imm. ♀ from the islet of Keramiah, off the south coast of Billiton. One immature bird from Billiton is dated 12th May.

The male has the under wing coverts and axillaries just tipped with white. The type locality of *musicus* is Sumatra: Borneo is inhabited by other races. A subspecies (*nesiotes* OBERH.) has been described from Banka but I have no material from that island.

Kittacincla malabarica tricolor (VIEILL.).

Kittacincla macroura, VORDERM., p. 496.

6 ♂, 2 juv. Wings 91, 90, 90, 90, 98, 95 mm.

These males do not differ appreciably from males of *tricolor* from West Java (*terr. typ.*), and Sumatra: the Bornean races are distinct. Dr. H. C. OBERHOLSER has associated birds from Billiton with *K. m. abbotti* OBERH., described from Banka (Smiths. Misc. Coll., 76, No. 6, 1923, p. 5). Even in its type locality *tricolor* is very variable in the colour of the under parts.

Geokichla sibirica sibirica (PALL.).

1 ♂. A migrant dated 30th March, Wing, 122 mm.

SYLVIIDAE.

Orthotomus sericeus hesperius OBERH.

Orthotomus ruficeps, VORDERM., p. 493.

1 imm. ♂.

An old specimen, once mounted, from Billiton was also sent for examination with the present collection. The wing measures 50 mm in length. Birds from Sumatra (*terr. typ.*, Lingga Island) and Billiton seem inseparable and just separable from the Bornean *sericeus* by reason of very slightly less clear grey upper parts.

Orthotomus sepium ruficeps (LESS.).

Orthotomus borneoensis and *O. cineraceus*, VORDERM., pp. 491, 492.

1 ♀ imm.

Exactly like birds in a similar state of plumage from Sumatra (*terr. typ.*): a Bornean race (*borneonensis*) seems just separable.

Orthotomus atrogularis atrogularis TEMM.

Orthotomus flavoviridis, VORDERM., p. 494; *O. atrogularis*, KLOSS, p. 297.

1 ♀, Wing 43 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Malacca). The Banka race has been described as *eumelas* OBERH.: I have no material for comparison.

Cisticola juncidis malaya LYNES.

Cisticola cursitans, VORDERM., p. 496.

3 ♂, 1 ♀. Wings ♂ 50, 51; ♀ 47 mm.

Birds from Sumatra (*terr. typ.*, Malay Peninsula) and Billiton seem inseparable. The species does not occur in Borneo.

ARTAMIDAE.

Artamus leucorhynchus amydrus OBERH.

VORDERM., p. 455.

2 ♂, 1 ♀. Wings ♂ 135 (imm.), 135; ♀ 131 mm.

Birds from Sumatra and Billiton seem alike (*terr. typ.*, Solombo Besar Island, Java Sea). Bornean birds are best placed under the typical race described from the Philippine Islands.

LANIIDAE.

Hemipus hirundinaceus (TEMM.).

Myiolestes obscurus, VORDERM., p. 460.

2 ♂, 1 ♀ 3 ex., Wings ♂ 60, 62; ♀ 66; sex? 62, 62, 63 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

Pachycephala cinerea butaloides STRES.

1 ♂. Wing 81 mm.

Birds from Sumatra, South Borneo and Billiton seem inseparable (*terr. typ.*, Java).

ZOSTEROPIDAE.

Zosterops chloris solombensis OBERH.

Zosterops solombensis OBERHOLSER, Proc. U. S. Nat. Mus., 54, 1917, p. 188 (Solombo Besar Island, East Java Sea).

1 ♂, 2 ♀. Wings ♂ 54; ♀ 54, 55 mm. Islet of Keramiah, off the south coast of Billiton.

These specimens are strikingly less yellow and more olive green above than *Z. c. maxi* and clearly belong to another race. They agree well with the colour description of *solombensis* the type of which, however, with a wing length of 58 mm is slightly larger than the Billiton specimens. Except for the presence of *maxi* in the Karimata group it would seem, therefore, that a bright form of *Z. chloris* has infiltrated along the southern islands of the Java Sea and that this duller form has spread along the northern islands.

DICAEIDAE.

Dicaeum trigonostigmum trigonostigmum (SCOP.).

VORDERM., p. 463; KLOSS, p. 298.

3 ♂. Wings 47, 48, 50 mm.

Birds from Sumatra and Billiton are alike (*terr. typ.*, Malacca): the Bornean race is separable (*dayakanum*).

Anaimos percussus ignicapillus (EYTON).

Prionochilus percussus, VORDERM., p. 461; *P. p. ignicapillus*, KLOSS, p. 298.

1 ♂. Wing 53 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Malacca).

Anaimos thoracicus (TEMM.).

Prionochilus thoracicus, VORDERM., p. 461; KLOSS, p. 298.

3 ♂. Wing 55, 57.5, — mm.

These birds from Billiton are very slightly brighter on the mantle than a small series from Borneo and the Malay Peninsula and one specimen has minute white tips to the tail feathers, a character not present in my specimens from elsewhere. The series examined, however, are too small to justify any separation of this rather uncommon flower-pecker into subspecies. The species is not recorded from Sumatra.

Anaimos maculatus maculatus (TEMM.).

Prionochilus maculatus, VORDERM., p. 462; KLOSS, p. 298.

3 ♂. Wings 52, 52, 53 mm.

Birds from Sumatra, Borneo (*terr. typ.*), and Billiton seem inseparable.

NECTARINIIDAE.

Chalcostetha calcostetha calcostetha (JARD.).

Chalcostetha insignis, VORDERM., p. 466; KLOSS, p. 297.

3 ♂. Wings 61, 60, 59 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

Aethopyga siparaja siparaja (RAFFLES).

VORDERM., p. 446; KLOSS, p. 297.

2 ♂. Wings 51, 51 mm.

Birds from Sumatra (*terr. typ.*), Borneo and Billiton seem inseparable.

Leptocoma brasiliana brasiliana (GMEL.).

Nectarophila hasseltii, VORDERM., p. 466; *L. brasiliana*, KLOSS, p. 298.

3 ♂. Wings 46, 48, 49 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

Leptocoma jugularis microleuca (OBERH.).

1 ♂, 1 ♀. Wing ♀ 54 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Taya Island, south-east Sumatra).

The Banka bird has been described as *Cinnyris ornata heliozeteta* OBERH.: I have no material from the island for comparison.

Anthreptes malacensis malacensis (SCOP.).

VORDERM., p. 468.

4 ♂, 2 imm. ♂, 3 ♀ from Billiton; 1 ♀ from Lima Island about 21 kilometres west of Billiton. Wings ♂ 65, 67, 64, 65; ♀ 61, 61, 62, 62 mm.

Birds from Sumatra, Billiton and West Borneo seem inseparable.

Chalcoparia singalensis sumatrana KLOSS.

Chalcoparia singalensis, VORDERM., p. 298; *C. singalensis sumatrana*, KLOSS p. 298.

2 ♂, 1 ♀. Wings 54, 54, 53 mm.

Birds from Sumatra (*terr. typ.*) and Billiton seem alike: a Bornean subspecies (*borneana*) is distinct, but I am not yet sure that specimens from West Borneo should be referred to *borneana*.

Arachnothera longirostris longirostris (LATH.).

VORDERM., p. 470.

1 ♂, 2 ♀. Wings, 64, 59, 64 mm.

Referable to the typical form to which the Sumatran race belongs. The Bornean subspecies (*büttikoferi*) is distinct.

MOTACILLIDAE.

Motacilla flava simillima HART.

1 ♂, 3 ♀. Wings ♂ 81; ♀ 75, 76, 78 mm.

Of these migrants, one female (2nd May) is in almost full plumage; the

male (1st October) is immature with whitish under parts; the second female (8th October) is also immature, but has the under parts tinged with yellow. An adult female dated 4th July is in worn plumage.

PLOCEIDAE.

Padda oryzivora oryzivora (LINN.).

1 ♂, 1 ♀. Wings 68, 69 mm.

Birds from Sumatra, Borneo and Billiton are alike (*terr. typ.*, Java), but the species has now such an artificial geographic range that it does not lend itself to a discussion on faunas.

Munia punctulata fretensis KLOSS.

1 ♂, 2 ♀. Wings ♂ 50; ♀ 51, 51 mm.

Birds from Sumatra and Billiton seem alike (*terr. typ.*, Malay Peninsula): the species does not occur in Borneo.

GRACULIDAE.

Gracula religiosa prasiocara OBERH.

Gracula javanensis, VORDERM., p. 498.

3 ♂, 1 ♀. Wings ♂ 192, 175, —; ♀ 178 (*c*) mm. The collection also contains two juveniles dated 9th April.

Birds from Sumatra and Borneo seem inseparable, but one of the Billiton males is so large that the island race is best referred to the rather ill-defined subspecies, characterized by large average size, inhabiting the islands of the ocean tract separating Borneo from the Malay Peninsula and Sumatra, eg., the Anamba, Tambelan and Tioman Islands.

Aplonis panayensis strigatus (HORSF.).

Calornis chalybaea, VORDERM., p. 497.

3 ♂, 4 ♀. Wings ♂ 98, 101, 102; ♀ 98, 98, 97, 100 mm.

Birds from Sumatra, Borneo and Billiton seem inseparable (*terr. typ.*, Java).

ORIOLIDAE.

Oriolus chinensis maculatus VIEILL.

Oriolus indicus, VORDERM., p. 499.

4 ♂, Wings —, —, 139, 141 mm 1 ♀ imm. Wing, 141 mm.

Birds from Sumatra and Billiton seem alike (*terr. typ.*, Java): the same subspecies also occurs in Borneo, but I have never examined specimens from that island where the bird seems curiously rare for a resident.

A List of the Birds of Billiton.

The letters after the names indicate the collectors, VORDERMAN, BRAUTIGAM, *ex. Mus. Tweedale,* and KUIPER.

Species.	Common to Sumatra and Borneo.	Found in Sumatra but not Borneo.	Found in Borneo but not Sumatra.	Affinities with China Sea Islands.	Affinities elsewhere.	Peculiar to Billiton.	Migrants, shore-birds etc.
Phasianidae.							
Rollulus roulroul (SCOP.). V. K.	×						
Excalfactoria chinensis palmeri RILEY. V. K.	×						
Turnicidae.							
Turnix suscitator kuiperi CHAS. V. K.						×	
Columbidae.							
Treron curvirostra curvirostra (GMEL.). V. K.	×						
Treron fulvicollis fulvicollis (WAGL.). V. K.	×						
Treron vernans griseicapilla SCHLEG. V. K.	×						
Ptilinopus jambu (GMEL.). V.	×						
Ducula aenea aenea (LINN.). V. K.	×						
Myristicivora bicolor bicolor (SCOP.). V. K.	×						
Geopelia striata striata (LINN.). K.	×						
Streptopelia chinensis tigrina (TEMM.). V. K.	×						
Chalcophaps indica indica (LINN.). V. K.	×						
Caloenas nicobarica nicobarica (LINN.). V.	×						
Rallidae.							
Rallina fasciatus RAFFLES. T.	×						
Rallus striatus gularis HORSF. K.		×					
Amaurornis phoenicurus javanicus (HORSF.). K.	×						
Gallicrex cinerea plumbea (VIEILL.). K.	×						
Charadriidae.							
Charadrius apricarius fulvus GMEL. K.							×
Charadrius leschenaulti leschenaulti LESS. K.							×
Charadrius mongolus atrifrons WAGL. K:							×
Charadrius peronii SCHLEG. K.	×						
Charadrius dubius curonicus GMEL. K.							×
Squatarola squatarola australis REICH. K.							×
Scolopacidae.							
Numenius madagascariensis (LINN.). K.							×
Numenius arquata orientalis BHEHM. K.							×
Numenius phaeopus variegatus (SCOP.) V. K.							×
Limosa lapponica baueri NAUM. K.							×
Capella stenura (BP.). K.							×

Species.	Common to Sumatra and Borneo.	Found in Sumatra but not Borneo.	Found in Borneo but not Sumatra.	Affinities with China Sea Islands.	Affinities elsewhere.	Peculiar to Billiton.	Migrants, shore-birds etc.
Erolia testacea (*PALL.*). K.							×
Erolia ruficollis (PALL.). K.							×
Tringa totanus eurhinus (OBERN.). K.							×
Tringa nebularia (GUNN.). K.							×
Tringa hypoleucos (LINN.). K.							×
Glareolidae.							
Glareola isabella VIEILL. V.							×
Glareola pratincola maldivarum FORST. K.							×
Laridae.							
Sterna bergii cristata STEPH. K.							×
Sterna bengalensis bengalensis LESS. K.							×
Sterna anaethetus anaethetus SCOP. K.							×
Sterna sumatrana sumatrana RAFFLES. K.							×
Anoüs minutus worcesteri (MCGREG.). K.							×
Anoüs stolidus pileatus (SCOP.). K.							×
Ardeidae.							
Egretta intermedia intermedia (WAGL.). V.	×						
Demigretta sacra sacra (GMEL.). K.	×						
Ardea sumatrana sumatrana RAFFLES. T.	×						
Goisakius melanolophus melanolophus (RAFFLES). K.	×						
Dupetor flavicollis flavicollis (LATH.). K.	×						
Butorides striatus javanicus (HORSF.). V. K.	×						
Ixobrychus sinensis sinnesis (GMEL.). K.	×						
Ixobrychus eurhythmus (SWINH.). K.	×						
Leptoptilos javanicus (HORSF.). V.	×						
Fregatidae.							
Fregata andrewsi MATH. V. K.							×
Fregata ariel ariel (G. R. GRAY). K.							×
Anatidae.							
Dendrocygna javanica javanica (HORSF.) K.	×						
Falconidae.							
Accipiter virgatus gularis (TEMM. & SCHLEG.). B. K.							×
Spizaëtus cirrhatus limnaetus HORSF. K.	×						
Spizaëtus nipalensis alboniger (BLYTH). K.	×						
Spilornis cheela natunensis CHAS. K.				×			
Haliaeetus leucogaster (GMEL.). K.	×						
Haliastus indus intermedius GURN. V. K.	×						

Species.	Common to Sumatra and Borneo.	Found in Sumatra but not Borneo.	Found in Borneo but not Sumatra.	Affinities with China Sea Islands.	Affinities elsewhere.	Peculiar to Billiton.	Migrants, shore-birds etc.
Pernis apivorus japonicus KURODA. K.							×
Falco peregrinus calidus LATH. K.							×
Pandionidae.							
Pandion haliaetus cristatus (VIEILL.). K.							×
Strigidae.							
Otus bakkamoena lempiji (HORSF.). V.	×						
Bubo ketupa ketupa (HORSF.). V. K.	×						
Strix leptogrammica leptogrammica TEMM. K.			×				
Phodilus badius parvus CHAS. K.						×	
Psittacidae.							
Psittacula longicauda defontainei CHAS. V. K. ...				×			
Loriculus galgulus galgulus (LINN.). V. K.	×						
Podargidae.							
Batrachostomus javensis (HORSF.). K.	×						
Coraciidae.							
Eurystomus orientalis orientalis (LINN.). V. K.	×						
Eurystomus orientalis calonyx SHARPE. K.							×
Alcedinidae.							
Ramphalcyon capensis cyanopteryx OBERH. V. K.		×					
Ceyx rufidorsus STRICKL. V. K.	×						
Alcedo meninting verrauxii DE LA BERGE. V. K.	×						
Alcedo atthis bengalensis GMEL. K.	×						
Halcyon sancta sancta VIG. and HORSF. V. K. ...							×
Halcyon chloris cyanescens (OBERH.). V. K.	×						
Halcyon coromanda minor TEMM. and SCHLEG. B.K.	×						
Halcyon concreta concreta (TEMM.). V. K.		×					
Halcyon pileata (BODD.). K.	×						
Bucerotidae.							
Anthracoceros malayanus (RAFFLES). K.	×						
Meropidae.							
Merops viridis viridis LINN. V. K.	×						
Merops superciliosus javanicus HORSF. K.							×
Caprimulgidae.							
Caprimulgus concretus concretus BP. V. K.	×						
Caprimulgus affinis affinis HORSF. V. K.	×						

Species.	Common to Sumatra and Borneo.	Found in Sumatra but not Borneo.	Found in Borneo but not Sumatra.	Affinities with China Sea Islands.	Affinities elsewhere.	Peculiar to Billiton.	Migrants, shore-birds etc.
Micropodidae.							
Collocalia vestita vestita (LESS.). V.		×					
Collocalia esculenta cyanoptila OBERH. K.	×						
Collocalia francica subsp. K.			?				
Hemiprocne longipennis harterti (STRES.). V. K.	×						
Cypsiurus batasiensis infumatus (SCLAT.) K.	×						
Micropus affinis subfurcatus (BLYTH). K.	×						
Trogonidae.							
Harpactes duvauceli (TEMM.). V. K.	×						
Cuculidae.							
Cuculus micropterus micropterus GOULD. K.							×
Hierococcyx fugax nisicolor (HODGS.). B.							×
Hierococcyx fugax fugax (HORSF.). K.	×						
Chalcites basalis (HORSF.). K.							×
Cacomantis variolosus sepulcralis (S. MJLL.). V.	×						
Eudynamys scolopaceus scolopaceus (LINN.). K.							×
Centropus bengalensis javanicus (DUM.). K.	×						
Rhopodytes sumatranus (RAFFL.). V. K.	×						
Capitonidae.							
Chotorea rafflesii billitonis CHAS. V. K.						×	
Picidae.							
Callolophus miniaceus malaccensis (LATH.). V. K.	×						
Dryobates moluccensis moluccensis (GMEL.). V. K.	×						
Meiglyptes tukki tukki (LESS.). V. K.	×						
Micropternis brachyurus badius (RAFFL.) V. K.		×					
Sasia abnormis abnormis (TEMM.). V.	×						
Eurylaimidae.							
Eurylaimus javanicus billitonis KLOSS. V. K.						×	
Eurylaimus ochromalus ochromalus (RAFFL.) V. K.		×					
Cymbirhynchus macrorhynchus malaccensis SALVAD. V. K.		×					
Pittidae.							
Pitta sordida bangkana SCHLEG. V. K.					×		
Pitta brachyura cyanoptera TEMM. K.	×						
Hirundinidae.							
Hirundo rustica gutturalis SCOP. K.							×
Hirundo tahitica abbotti (OBERH.). V. K.	×						

Species.	Common to Sumatra and Borneo.	Found in Sumatra but not Borneo.	Found in Borneo but not Sumatra.	Affinities with China Sea Islands.	Affinities elsewhere.	Peculiar to Billiton.	Migrants, shore-birds etc.
Muscicapidae.							
Hypothymis azurea prophata OBERH. V. K.	×						
Rhipidura javanica longicauda WALL. V. K. ...	×						
Tersiphone paradisi australis CHAS. V. K.		×					
Rhinomyias olivacea olivacea (HUME). K.	×						
Rhinomyias umbratilis umbratilis (STRICK.). V.	×						
Campephagidae.							
Lalage nigra nigra (FORST.). K.		×					
Pericrocotus igneus igneus (BLYTH.). V. K.	×						
Pycnonotidae.							
Aegithina viridissima viridissima (BP.). V. K.	×						
Chloropsis cochinchinensis billitonis CHAS. V. K.						×	
Chloropsis sonnerati zosterops VIG. V. K.	×						
Irena puella criniger SHARPE. V. K.	×						
Iole olivacea olivacea BLYTH. V. K.		×					
Brachypodius atriceps atriceps (TEMM.). V. K.	×						
Alophoixus phaeocephalus phaeocephalus (HARTL. V. K.		×					
Pycnonotus goiavier personatus (HUME). V. K.		×					
Pycnonotus plumosus billitonis CHAS. V. K.						×	
Pycnonotus simplex perplexus CHAS. & KLOSS. K.			×				
Pycnonotus erythropthalmos *subsp.* V.	?						
Timaliidae.							
Pellorneum capistratum nigrocaptitatum (EYTON). V. K.		×					
Malacocincla abbotti eritora OBERH. K.						×	
Aethostoma rostratum subsp. V.	?						
Anuropsis malaccensis saturata (ROB. & KLOSS). V. K.			×				
Cyanoderma erythroptera apega OBERH. V. K.					×		
Mixornis gularis? ruficoma OBERH. V. K.					?		
Macronus ptilosus sordidus CHAS. V. K.						×	
Turdidae.							
Turdus obscurus obscurus (GM).						×	
Geokichla sibirica sibirica (PALL.). K.						×	
Copsychus saularis musicus (RAFFLES). V. K. ...		×					
Kittacincla malabarica tricolor (VIEILL.). V. K.		×					
Sylviidae.							
Orthotomus sericeus hesperius OBERH. V. K. ...		×					

Species.	Common to Sumatra and Borneo.	Found in Sumatra but not Borneo.	Found in Borneo but not Sumatra.	Affinities with China Sea Islands.	Affinities elsewhere.	Peculiar to Billiton.	Migrants, shore-birds etc.
Orthotomus sepium ruficeps (LESS.). V. K.		×					
Orthotomus atrogularis atrogularis TEMM. V. K.	×						
Cisticola juncidis malaya LYNES. V. K.		×					
Artamidae.							
Artamus leucorhynchus amydrus OBERH. V. K.		×					
Laniidae.							
Hemipus hirundinaceus (TEMM.). V. K.	×						
Pachycephala cinerea butaloides Stres. K.	×						
Zosteropidae.							
Zosterops chloris solombensis OBERH. K.					×		
Dicaeidae.							
Dicaeum trigonostigmum trigostigmum (SCOP.).		×					
Anaimos percussus ignicapillus (EYTON). V. K.	×						
Anaimos thoracicus (TEMM.). V. K.			×				
Anaimos maculatus maculatus (TEMM.). V. K. ...	×						
Nectariniidae							
Chalcostetha calcostetha calcostetha (JARD.) V. K.	×						
Aethopyga siparaja siparaja (RAFFLES). V. K.	×						
Leptocoma brasiliana brasiliana (GMEL.). V. K.	×						
Leptocoma jugularis microleuca (OBERH.). K. ...	×						
Anthreptes malacensis malacensis (SCOP.). V. K.	×						
Chalcoparia singalensis sumatrana (KLOSS.). V. K.		×					
Arachnothera longirostris longirostris (LATH.) V. K.		×					
Motacillidae.							
Motacilla flava simillima HART. K.							×
Ploceidae.							
Padda oryzivora oryzivora (LINN.). K.	×						
Munia punctulata fretensis KLOSS. K.		×					
Graculidae.							
Gracula religiosa prasiocara OBERH. V. K.				×			
Aplonis panayensis strigatus (HORSF.). V. K. ...	×						
Oriolidae.							
Oriolus chinensis maculatus VIEILL. V. K.	×						

F. KOPSTEIN: Schlangen von Enggano.
Fig. 1. *Elaphe enganensis* VINCIGUERRA. — Fig. 2. *Elaphe subradiata* (SCHLEGEL). — Fig. 3. *Elaphe flavolineata* (SCHLEGEL).

SCHLANGEN VON ENGGANO.

Von

Dr. FELIX KOPSTEIN

(Magelang, Java).

Das Material zu dieser Beschreibung wurde von Herrn Dr. J. K. DE JONG während seiner, in den Monaten Mai bis Juli 1936 durchgeführten Studienreise gesammelt und mir zur Durchsicht zur Verfügung gestellt. Diese Freundlichkeit meine ich besonders darum hoch einschätzen zu müssen, da Herr DE JONG selbst Herpetologe, und als solcher gut bekannt ist. Mein Interesse für die indo-australische Schlangenfauna aber veranlasste Dr. DE JONG doch, mir sein eigenes Studienmaterial zu überlassen.

Die Reptilien- und Amphibienfauna von Enggano wurde bereits vor ungefähr 45 Jahren von VINCIGUERRA untersucht und in seiner Schrift „Rettili e Batraci di Enggano [1])" festgelegt. V. beschrieb von dieser, der Westküste Sumatras vorgelagerten Insel 4 Schlangen: *Coluber enganensis* n. sp., *Psammodynastes pulverulentus*, *Cerberus rhynchops* und *Platurus colubrinus*. DE ROOY's Faunenliste [2]) konnte dieser kleinen Serie keine Erweiterung zukommen lassen und auch die neue Untersuchung durch DE JONG fügte ihr bloss noch *Python reticulatus* bei. Wir dürfen daher annehmen, dass Enggano tatsächlich an Schlangen artenarm ist.

Enggano liegt 5° südlich vom Aequator und 102° ö. L. v. Gr. Die Insel bedeckt ungefähr 400 km² und erhebt sich an einzelnen Stellen bis zu 360 m Höhe. Sie ist, nach DE JONG, auch heute noch von dichtem Urwald bedeckt, abgesehen von einem 100 - 300 m breiten Streifen längs der Küste, welcher mit Kokospalmen und spärlichen anderen Kulturgewächsen bepflanzt ist.

Alle Schlangen DE JONGS tragen die Etiketten Meok, Kajaäpoe und Boeah Boeah. Meok liegt an der Nordküste der Hauptinsel, Kajaäpoe an der Ostküste, während Boeah Boeah im Süden, etwa 100 m hoch gelegen ist.

Elaphe enganensis VINCIGUERRA (Pl. 1, Fig. 1).

1 ad. ♂; Sq. 27-23-21; V. 233 + 1; Sc. 114/114 + 1; Länge 130 cm;
1 ad. ♂; Sq. 25-23-21; V. 228 + 1; Sc. 114/114 + 1; Länge 135 cm;
1 juv. ♂; Sq. 27-23-21; V. 235 + 1; Sc. 109/109 + 1; Länge 47 cm.

Die beiden ad. Exemplare wurden bei Boeah Boeah, die Jugendform bei Meok gefangen.

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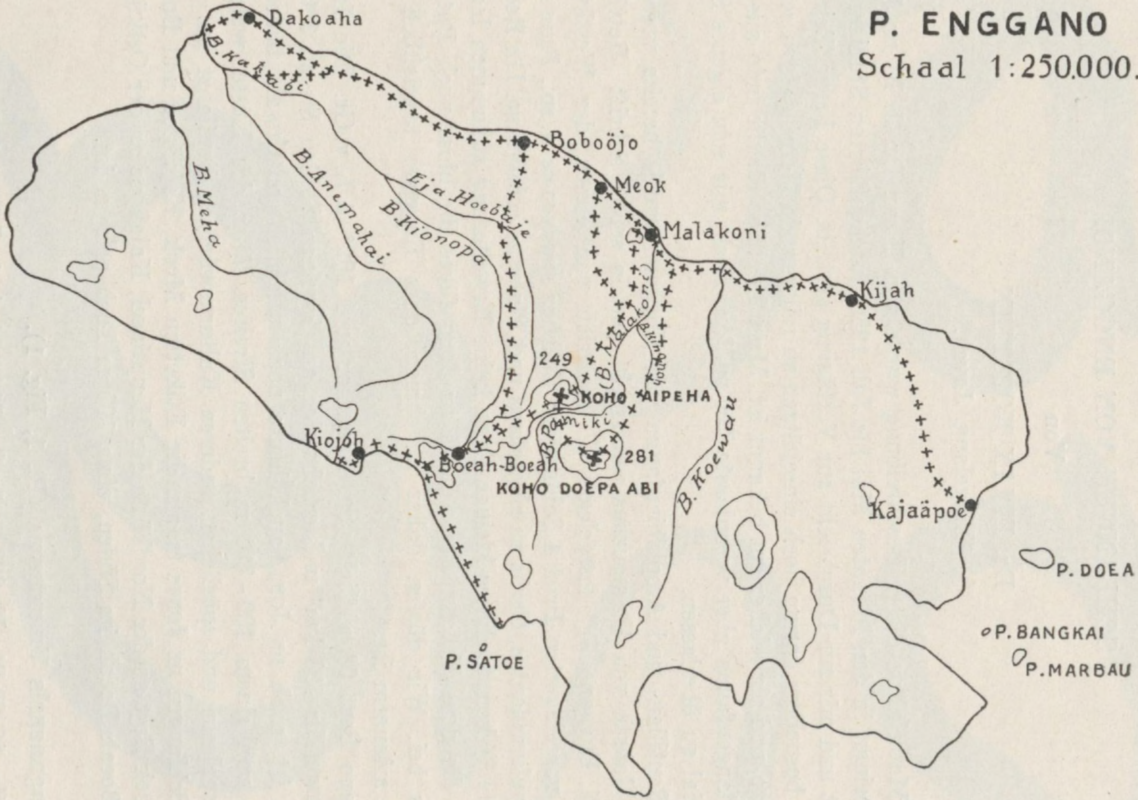
[1]) Ann. Mus. Genova; XII; 1892. p. 517/26.
[2]) The reptiles of the Indo-Australian Archipelago. Leiden, 1917.



Karte der Insel Enggano. ++++ = Fusswege.

Rostrale deutlich breiter als hoch. Loreale länger als hoch. Internasalia kürzer als die Praefrontalia; letztere bei einem Exemplar teilweise miteinander verwachsen. Frontale ebenso lang als seine Entfernung von der Schnauzenspitze (bei dem juv. ♂ länger), kürzer als die Parietalia. 1 Prae-, 2 Postocularia. Supralabialia 9 (4, 5, 6). Kein Suboculare. Dies stimmt mit MERTENS Beobachtung [1]) überein, dass nämlich bei Exemplaren von *Elaphe subradiata*, welche ein Suboculare besitzen, bloss das 5. + 6. Supralabiale an das Auge grenzt, bei Exemplaren ohne Suboculare jedoch das 4., 5. und 6. 2 vordere Temporalia. 6 (bei einem Ex. auf einer Seite 7) Sublabialia grenzen an das vordere Kinnschild. Beide Kinnschildpaare ungefähr gleich lang. Die dorsalen Schuppen sind stark, die lateralen schwächer gekielt. Die äussersten Schuppenreihen glatt.

Oberseits sind beide ad. Stücke einfärbig braun, ohne dorsale Linien oder Flecke. Bei einem der beiden Exemplare sind auf dem Hals einige dünklere Flecke angedeutet. Der dunkle Postocularstreifen ist gut sichtbar, aber unscharf abgegrenzt. Ventralia auf der distalen Körperpartie seitlich braun, oder braun gewölkt.

Beide ad. Exemplare stimmen gut mit der von BRONGERSMA [2]) gegebenen Beschreibung von VINCIGUERRA's Cotype überein.

Ausser den beiden adulten Exemplaren enthält die Sammlung DE JONG noch ein sehr jugendliches Stück, welches in vieler Hinsicht merkwürdig ist. Während die Beschuppung mit jener der erwachsenen Tiere übereinstimmt, weicht die Färbung und Zeichnung sehr stark davon ab. Das Gesamtbild gleicht weitaus mehr der Jugendform von *Elaphe flavolineata* als dem Bild der erwachsenen *Elaphe subradiata.* (Pl. 1, Fig. 2). Es ist aber auch von der Jugendform von *Elaphe subradiata* von den Kleinen Sunda-Inseln grundverschieden; diese stimmt beinahe völlig mit den erwachsenen Exemplaren überein.

Der Kopf der Jugendform ist dunkel olivenfärbig. Vom Nasale zieht ein schwarzer, mehrfach unterbrochener Streifen über den Augenrand des 4., 5. und 6. Supralabiale, geht in den charakteristischen Postocularstreifen über und endet mit einem kleinen, schwarzen Fleck auf dem letzten Supralabiale. In der Temporalgegend liegt ein dunkler Fleck. Das von BRONGERSMA erwähnte dunkle Band quer über den Kopf fehlt. Die Grundfarbe des Rumpfes ist nicht gelblichbraun wie bei den erwachsenen Tieren, sondern dunkel grau-schwarz. Auf dem Halse liegt eine laterale Reihe deutlicher, dunkler Flecke. Zwei dorsolaterale Reihen sind bloss angedeutet. Auf der Rumpfmitte nehmen diese Flecke die Form von undeutlich ausgebildeten Querbinden an, die über den ganzen Rücken reichen. Am wichtigsten ist jedoch der unscharf begrenzte, *goldgelbe Vertebralstreifen* auf der vorderen Körperhälfte, der in hohem Masse an die Jugendform von *Elaphe flavolineata* erinnert und der bei *Elaphe subradiata* stets fehlt. Rumpfende und Schwanzoberseite einfärbig schwärzlich. Unterseite einfärbig gelblich-weiss.

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[1]) Abh. Senckenberg. Nat. Ges. 42; 3; 1930; pag. 299.
[2]) Contributions to Indo-Australian Herpetology. Leiden 1934; p. 199.

Diese auffallende Uebereinstimmung der Jugendform von *Elaphe enganensis* mit *Elaphe flavolineata*, bei der gleichzeitig völligen Verschiedenheit gegenüber der Jugendform von *Elaphe subradiata* veranlasst mich, *Elaphe enganensis* als eigene Art festzuhalten, trotzdem die erwachsenen Stücke pholidotisch kaum oder gar nicht von *Elaphe subradiata* zu unterscheiden sind.

Python reticulatus (SCHNEIDER).

Kajaäpoe.

1 s.ad. Sq. 56-57-69-65-46; V.317 + 1; Sc. 49/49 +...... Schwanzspitze abgebrochen.

Supralab. 12 (7); 2 vordere und 5 (6) hintere Sublab. mit tiefen Gruben.

Cerberus rynchops (SCHNEIDER).

Meok.

1 s.ad. ♀. Sq. 23-23-19; V.153 + 1/1; Sc. 64/64 + 1.

Psammodynastes pulverulentus (BOIE).

Diese Art scheint auf der Insel recht häufig vorzukommen. Die Sammlung enthält 19 Exemplare (10 ♂, 6 ♀ und 3 jugentliche Stücke, bei welchen das Geschlecht nicht mit Sicherheit festzustellen ist). Alle Etiketten tragen die Fundortbezeichnung Meok und Boeah Boeah.

Die pholidotischen Merkmale sind in der unten stehenden Tabelle vereinigt. Sie demonstriert eine anmerkliche Konstanz der Kopfschilder, die MERTENS auch für sein klein-sundaisches Material feststellte. Wir finden konstant 1 Prae-, 2 Postocularia, 1 Loreale und 8 Supralabialia, von welchen stets das 3., 4. und 5. an das Auge grenzen. Bei jenen Exemplaren, bei welchen die Anordnung der Temporalia deutlich ist, sehen wir 7 mal 1 + 2 und 3 mal 2 + 3 Temporalia.

Merkwürdig ist die Verschiedenheit der Zahlen der Ventralia und Subcaudalia des Enggano-Materials im Vergleich zu MERTENS Sammlung von den Kleinen Sunda-Inseln. MERTENS fand dort die folgenden Zahlen:

♂ Ventralia 144 - 153; Subcaudalia 49-57;

♀ Ventralia 156 - 164; Subcaudalia 48 - 55.

Beim Enggano-Material beträgt die Ventralzahl bei den ♂ 161 - 170, bei den ♀ 171 - 176. Sie ist also auch auf dieser Insel bei den ♀ grösser als bei den ♂. Insgesamt ist die Zahl der Ventralia bei *Psammodynastes pulverulentus* auf Enggano grösser als im östlichen Teil des Archipels. Die Zahl der Subcaudalia ist bei den ♂ grösser als bei den ♀. Es ergaben sich für 6 Weibchen die Zahlen 62 - 72 (durchschnittlich 67) und für 9 Männchen 65 - 74 (durchschnittlich 70). Auch die Zahlen der Subcaudalia sind auf Enggano höher als auf den Kleinen Sunda-Inseln.

Diese höheren Werte stehen damit in Verband, dass *Psammodynastes pulverulentus* auf Enggano überhaupt grösser wird als in den anderen Gebieten des indo-australischen Archipels. DE ROOY gibt als grösste Länge 625 mm an,

was mit meinen Erfahrungen übereinstimmt. Das grösste Stück aus der Sammlung MERTENS von Lombok misst 550 mm, während das grösste ♀ von Enggano eine Länge von 770 mm hat. 4 ad. ♀ von Enggano massen 73.5 - 77 cm, 9 erwachsene ♂ 55 - 65 cm.

Diese anmerkliche Grössenzunahme auf einer kleinen Insel reihe ich ins Kapitel der insularen Riesenformen ein, ebenso wie ich die sehr dunkle, beinahe schwarze Farbe von 5 Weibchen als Einfluss der Isolierung auf einer kleinen Insel erkläre. Besonders im Leben zeigten diese ♀, die ich dank der Liebenswürdigkeit Herrn DE JONGS eine Zeit lang lebend beobachten konnte, eine so tief dunkle Grundfarbe, wie ich sie bei der gleichen Art auf Java niemals sah. Von den 6 ♀ zeigte bloss eines einen helleren, bräunlichen Grundton, während unter den 10 ♂ gerade umgekehrt bloss 1 Exemplar dunkel und 9 mehr oder weniger hell braun waren. Dieser Geschlechtsdimorphismus ist bei *Psammodynastes* bereits lange bekannt. Die auf Java häufigen Längs- und Querbänder fehlen dem Enggano-Material. Bei einigen Exemplaren sind sie eben augedeutet.

Während *Psammodynastes pulverulentus* auf Java eine Gebirgsform darstellt, welche meist erst bei ± 1400 m gefunden wird, wurde sie auf Flores in 700 - 1200 m Höhe (zweimal aber schon in 200 m Höhe) und auf Lombok und Sumbawa schon bei ± 400 m angetroffen. Einmal fand MERTENS auf Flores ein Exemplar im Flachland.

Auf Enggano fand DE JONG alle Stücke von der Küste bis 100 m hoch.

Geschlecht	totale Länge in cm	Sq.	V.	Sc.	Praeocularia	Postocularia	Temporalia	Supralabialia	Sublabialia berühren das vordere Kinnschild	Lorealia
♀	75.5	17-17-15	176 + 1	72/72 + 1	1	2	2 + 3	8 (3, 4, 5)	3	1
♀	74.5	17-17-15	171 + 1	64/64 + 1	1	2	undeutlich	8 (3, 4, 5)	3	1
♀	54	17-17-15	174 + 1	67/67 + 1	1	2	„	8 (3, 4, 5)	3	1
♀	73.5	17-17-15	171 + 1	62/62 + 1	1	2	1 + 2	8 (3, 4, 5)	3	1
♀	77	17-17-15	175 + 1	63/63 + 1	1	2	2 + 3	8 (3, 4, 5)	3	1
♀	45.5	17-17-15	175 + 1	72/72 + 1	1	2	undeutlich	8 (3, 4, 5)	3	1
♂	62.5	17-17-15	168 + 1	69/69 + 1	1	2	undeutlich	8 (3, 4, 5)	3	1
♂	57	17-17-15	165 + 1	74/74 + 1	1	2	1 + 2	8 (3, 4, 5)	3	1
♂	65	17-17-15	168 + 1	65/65 + 1	1	2	2 + 3	8 (3, 4, 5)	3	1
♂	61	17-17-15	170 + 1	69/69 + 1	1	2	1 + 2	8 (3, 4, 5)	3	1
♂	63	17-17-15	161 + 1	69/69 + 1	1	2	1 + 2	8 (3, 4, 5)	3	1
♂	61.5	17-17-15	162 + 1	65/65 + 1	1	2	undeutlich	8 (3, 4, 5)	3	1
♂	55.5	17-17-15	163 + 1	72/72 + 1	1	2	„	8 (3, 4, 5)	3	1
♂	55	17-17-15	165 + 1	73/73 + 1	1	2	1 + 2	8 (3, 4, 5)	3	1
♂	58	17-17-15	165 + 1	70/70 + 1	1	2	1 + 2	8 (3, 4, 5)	3	1
♂	48	17-17-15	162 + 1	?	1	2	1 + 2	8 (3, 4, 5)	3	1

Laticauda colubrina (SCHNEIDER).

1 ad. ♂; Meok; Sq. 23-25-23; V.239 + 1/1 + 1/1; Sc. 36/36.

1 ad. ♀; Meok; Sq. 23-25-23; V.238 + 1/1 + 1/1; Sc. 36/36.

1 s.ad. ♂; Kajaäpoe; Sq. 23-23-21; V.230 + 1/1 + 1/1; Sc. 51/41.

Nasale in Berührung mit den 2 vordersten Supralabialen. Supralabialia 7 (3, 4). Das zwischen den Praefrontalen gelegene, unsymmetrische Schild beinahe eben so gross als ein Praefrontale. Frontale länger als seine Entfernung von der Schnauzenspitze. 2 Paar gut entwickelte Sublingualia, jederseits mit 5 Infralabialen in Berührung. Zwischen den vorderen Sublingualen ein kleines, unsymmetrisches Schild.

Bei den ♂ ist ein medialer Ventralkiel distal gut sichtbar. Lateralkiele fehlen.

Die beiden ♂ haben 36, das ♀ 34 dunkle Ringe, welche ventral schmäler und manchmal unterbrochen sind.

Das ♀ enthält 11 Eier.

ON A COLLECTION OF BIRDS FROM THE KRAKATAU GROUP OF ISLANDS, SUNDA STRAIT.

By

F. N. CHASEN

(Director, Raffles Museum, Singapore).

Through the kindness of Dr. K. W. DAMMERMAN, Director of the Zoological Museum, Buitenzorg, Java I have had the privilege of examining a collection of birds made in the Krakatau group of volcanic islets situated in the Sunda Strait between Sumatra and Java.

The volcanic eruption of Krakatau in August 1883, one of the greatest natural catastrophes known to man, has been described in detail in many places. The eruption provided naturalists with an unique opportunity for studying the genesis and development of an island fauna and of late years the biologists in the Netherlands Indies have exploited this opportunity to the full. In the now extensive bibliography dealing with the group special attention can be directed to a paper by Dr. K. W. DAMMERMAN in "Treubia", III, 1922, pp. 61 - 112, wherein are a sketch map, general discussions concerning the biology of the islands with a recapitulation of the problems involved and lists of the new fauna.

Whether or not any form of animal life could have survived the layer of hot ashes many metres thick is not a subject for discussion here, but it is at least certain that the birds must have been driven away, or destroyed.

Unfortunately we have no knowledge concerning the birds prior to the eruption. Knowledge subsequently acquired has been brought up-to-date by Dr. DAMMERMAN in the paper quoted above which is too fresh to need repeating in detail.

The present collection includes all the specimens mentioned in that paper obtained by the Zoological Museum, Buitenzorg, together with the material yielded by subsequent visits to the islands by officials of that institution.

The main object here has been to enquire as deeply as possible into the subspecific identity of the birds with a view to finding out from which directions the islands of Krakatau, Verlaten Island and Lang Island are being repopulated.

The collection adds to our knowledge in several directions.—

1. A few minor extensions of range within the group of species already recorded from the islands are, perhaps, not very important. *Dryobates m. moluccensis* is now known to extend to Verlaten and *Leptocoma jugularis microleuca* to Lang Island.

2. Additions to the lists of wandering coastal birds and true migrants are also relatively unimportant, for the migratory wave reaches Christmas Island in the Indian Ocean and further collecting in the Krakatau group will no doubt add many more names to the avifauna. The following species are here recorded for the first time. — *Arenaria i. interpres, Tringa nebularia, Charadrius apricarius fulvus, Alcedo atthis bengalensis, Alseonax l. latirostris, Zanthopygia narcissina zanthopygia* and *Acrocephalus stentoreus orientalis.*

3. The addition of two non-migratory species, *Macropygia phasianella emiliana* (Verlaten I.) and *Gerygone fusca sulphurea* (Krakatau and Verlaten I.) is more interesting. They are probably new-comers for it is unlikely that they were overlooked by previous collectors, one being a large, striking species and the other common in the islands.

4. The most noteworthy fact brought out by the present collection is that *Cyornis rufigastra rhizophorae,* which up to 1922 was only known from Sebesy, is now widely spread in the group. It is common on Krakatau; it breeds on Verlaten I., and it occurs on Lang Island. It seems reasonable to believe that fourteen years ago it was very rare and that its present status in the islands has only recently been attained.

The following brief analysis excludes Sebesy.—

1. Even before the eruption had died down migratory birds must have passed the islands and when the hot ashes cooled some of these birds were, no doubt, among the first visitors. The following species are known to occur. — *Arenaria i. interpres, Tringa hypoleucos, Tringa nebularia, Numenius phaeopus, Charadrius l. leschenaultii, Charadrius apricarius fulvus, Astur,* or *Accipter* sp. (probably *A. virgatus gularis*), *Hirundo rustica gutturalis, Zanthopygia narcissina zanthopygia, Alseonax l. latirostris, Acrocephalus stentoreus orientalis, Lanius cristatus superciliosus* and *Motacilla flava simillima.*

2. The widely spread sea-birds also form a group by themselves of no great interest to the zoo-geographer. — *Chlidonias leucoptera grisea, Sterna anaethetus* (or *S. fuscata nubilosa*), *S. dougalli bangsi, S. bergii cristata, S. s. sumatrana, Fregata* sp., and *Oceanodroma leucorhhoa monorhis.* A tern of some kind was found breeding on Verlaten I. in 1919.

3. A third group consists of well-known wanderers, birds of the coasts and mangrove swamps and species that habitually stray far afield in their daily foraging excursions. Such species give no clue as to the direction from which the islands were repopulated and they have, no doubt, always wandered along the coasts of the Sunda Straits and between Java and Sumatra using the small islands as stepping stones. — *Myristicivora bicolor bicolor, Esacus magnirostris scommophorus, Butorides striatus javanicus* (but perhaps the migratory subspecies, *amurensis*), *Demigretta s. sacra, Haliaeetus leucogaster, Haliastur indus intermedius, Halcyon chloris cyanescens, Alcedo atthis bengalensis, Micropus* sp. ("short forked tail and white rump"), and *Collocalia* sp. One of these (*Halcyon*) already breeds on Krakatau and Verlaten I. and several of the other species are also likely to settle down at any time.

4. Most important of all are the true non-migratory land-birds of which twenty-seven species have now been recorded from the islands and at least ten and perhaps eleven species, for oviduct eggs have been found in *Caprimulgus affinis*, breed locally. In this section I have included *Alcedo coerulescens*, but I know nothing of the habits of this small kingfisher and perhaps it should be included in section three, above. *Eudynamys scolopaceus malayanus* is also included although there is just a possibility that the birds are not resident.

(a). Nineteen of these non-migratory land birds occur in the same form in Sumatra and West Java. They therefore furnish no clue as to the exact provenance of the birds although as stated below there is reason for suspecting that the *Oriolus* is from Sumatra. — *Treron vernans griseicapilla, Geopelia s. striata, Chalcophaps i. indica, Macropygia phasianella emiliana, Amaurornis phoenicurus javanicus, Eudynamys scolopaceus malayanus, Centropus bengalensis javanicus, Caprimulgus a. affinis, Dryobates m. moluccensis, Hirundo tahitica javanica, Anthreptes m. malacensis, Lalage n. nigra, Artamus leucorhynchus amydrus, Pachycephala cinerea butaloides, Gerygone fusca sulphurea, Lanius schach bentet, Oriolus chinensis maculatus, Corvus m. macrorhynchos* and *Aplonis panayensis strigatus.*

(b). In the case of the remaining eight forms, four are Javan in origin and three Sumatran. The Javan forms are *Alcedo coerulescens, Dicaeum trigonostigmum flaviclune, Pycnonotus a. aurigaster* and *Cyornis rufigaster rhizophorae.* The Sumatran forms are *Leptocoma jugularis microleuca, Copsychus saularis musicus* and *Pycnonotus goiavier personatus.* The affinities of one form occurring on Verlaten (*Centropus sinensis* subsp.) have not been determined.

(c). The breeding forms are. — *Chalcophaps* (V.K.), *Amaurornis* (V.), *Centropus javanicus* (K.), *Halcyon chloris* (K.), ? *Caprimulgus affinis* (?K., ?V.), *Leptocoma* (V.), *Pycnonotus goiavier* (V.), *Cyornis* (V.), *Oriolus* (K.), *Aplonis* (V.), and *Lanius schach bentet* (K.V.).

The reoccupation of the Krakatau islands by birds seems to be proceeding in a casual rather than a regular manner. Two species observed in 1908, *Pycnonotus aurigaster* and *Alcedo coerulescens* ("*berylina*"), both Javan forms be it noted, have failed to establish themselves and *Lanius bentet* found in 1908 and reported as breeding in Verlaten I. and Krakatau in 1919 has not been obtained since 1920. It is certain that the list of casual visitors from both sides of the straits will grow and some of the species will, no doubt, establish themselves. On the neighbouring islet of Sebesy occur several forms not yet known from the Krakatau islets. — *Cacomantis* subsp., *Arachnothera l. longirostra, Geokichla interpres, Orthotomus sepium ruficeps, Munia punctulata fretensis* and *Kittacincla malabarica tricolor.* I have examined no example of the *Cacomantis;* the *Kittacincla* and *Geokichla* are common to Sumatra and Java and the other three forms are Sumatran, but not Javan. On the Java side, from the small island of Meeuwen, I have seen in a small collection such characteristic Javan forms as *Cyanops a. australis, Hypothymis azurea javanica, Aegithina*

tiphia scapularis, Orthotomus s. sepium and *Dicaeum t. trochileum.* The situation is interesting for in several cases distinct subspecies of one species are facing each other and separated by only a few miles of sea.

To summarize, it can be said that the bird-life of the Krakatau islets, annihilated in 1883 is now, fifty-four years later, abundant, but the resident population is not static, the lists of non-migratory and even breeding species made in 1908, 1922 and 1933 not being identical. The repopulation of the islands seems to have taken place in a thoroughly normal manner by forms, in the majority of cases, common to the lowlands of the adjacent mainlands and in the minority of cases by forms peculiar to one side, or the other, in about equal numbers. In no case have two subspecies of one species yet been recorded from any one island and I can discover no evidence of local differentiation, or any anomalous feature among the records, or collections examined.

COLUMBIDAE.

Treron vernans griseicapilla SCHLEG. (*Osmotreron vernans,* D.) [1]).

Krakatau. — 1 ♀, 7.1.33, D.; 1 ♂, 1 ♀, 1.5.33, D.; 1 ♂, 1 ♀, 7.4.34, M.; 1 ♂, 9.4.34, M.

Sebesy. — 1 ♀, 21.4.21, S.; 1 ♂, 24.4.21, S.

Birds from South Sumatra and West Java seem alike.

Myristicivora bicolor bicolor (SCOP.).

Krakatau. — 1 ♀, 22.9.20, S.

Found in both Sumatra and Java.

Macropygia phasianella emiliana BP.

Verlaten I. — 1 ♂, 6.1.33, D.

This form is common to both Java and Sumatra.

Chalcophaps indica indica (LINN.).

Krakatau. — 1 ♂, 22.9.20, S.; 2 ♀, 23.9.20, S.; 1 ♀, 22.7.24, D.

Verlaten I. — 1 ♂, 6.1.33, D.; 1 ♂, 10.12.33, D.; 1 ♂, 11.12.33, M.

Sebesy. — 1 ♂, 21.4.21, S.; 1 ♀, 29.4.21, S.

Found in both Sumatra and Java.

RALLIDAE.

Amaurornis phoenicurus javanicus (HORSF.).

Sebesy. — 1 ♂, 28.4.21, S.

Found in both Sumatra and Java.

LARIDAE.

Sterna bergii cristata STEPH.

Verlaten I. — 2 ♂, 1 ♀, 28.9.20, D. and S.

Widely distributed in Malaysian Seas.

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[1]) Where the names used here differ markedly from those used in Dr. DAMMERMAN's paper the latter are also given, in brackets. The capital letters are the initials of the collectors. — D., Dr. K. W. DAMMERMAN; S., Mr. H. C. SIEBERS; M., a Sundanese collector, MADZOED.

Sterna dougallii bangsi MATHS.

Verlaten I. — 4 ♂, 4 ♀, 28.9.20, D. and S.

Widely distributed in Malaysian Seas.

Sterna sumatrana sumatrana RAFFLES (*S. melanauchen,* D.).

Verlaten I. — 1 ♂, 6 ♀, 1 ex. 27.9.20, S.

Widely distributed in Malaysian Seas.

Fam. HYDROBATIDAE.

Oceanodroma leucorhoa monorhis (SWINH.).

Verlaten I. — 1 ♀, 23.10.21, D.

A wandering sea-bird.

BURHINIDAE.

Esacus magnirostris scommophorus (OBERH.). (*Orthoramphus magnirostris,* D.).

Verlaten I. — 1 ♀, 26.9.20, S.

Found in both Sumatra and Java.

SCOLOPACIDAE.

Arenaria interpres interpres (LINN.).

Verlaten I. — 1 ♂, 1 ♀, 12.11.32, D.

A migrant.

Tringa hypoleucos LINN.

Verlaten I. — 2 ♀, 27.9.20, S.; 10.12.33, D.

Sebesy. — 1 ♀, 29.9.20, S.

A migrant.

Tringa nebularia (GUNN.).

Verlaten I. — 1 ♂, 12.11.32, D.

A migrant.

CHARADRIIDAE.

Charadruis apricarius fulvus GMEL.

Verlaten I. — 1 ♂, 12.11.32, D.

A migrant.

Charadrius leschenaultii leschenaultii LESS. (*Ochthodromus geoffroyi,* D.).

Verlaten I. — 1 ♀, 26.4.21, S.

A migrant.

ALCEDINIDAE.

Halcyon chloris cyanescens (OBERH.).

Krakatau. — 1 ♀, 22.9.20, S.; 1 ♂, 20.7.24, D.; 1 ♂, 1.5.33, D.

Sebesy. — 1 ♀, 22.4.21, D.

Found in both South Sumatra and West Java.

Alcedo atthis bengalensis GMEL.

Verlaten I. — 1 ♂, 9.12.33, M.

Found in both South Sumatra and West Java.

CAPRIMULGIDAE.

Caprimulgus affinis affinis HORSF.

Krakatau. — 1 ♀, 25.9.20, S.

Verlaten I. — 1 ♂, 26.9.20, S.; 1 ♀, 28.9.20, S.; 1 ex. 16.2.28, D.; 1 ex. 2.5.29,D.; 1 ♂, 5.1.33, D.

Common to Sumatra and Java.

CUCULIDAE.

Eudynamys scolopaceus malayanus CAB. and HEINE. (*E. honorata*, D.).

Krakatau. — 1 ♀, 22.9.20, D.; 1 ♂, 23.9.20, D.

Verlaten I. — 1 ♀, 27.9.20, S.; 1 ♂, 9.12.33, M.

Sebesy. — 1 ♂, 29.9.20, D.; 1 ♂, 22.4.21, D.; 1 ♂, 24.4.21, S.

Common to both Sumatra and Java.

Centropus sinensis eurycercus HAY.

Sebesy. — 1 ♂, 29.9.20, S.

This is the race occurring in Sumatra: Javan birds (*bubutus*) run rather heavier in the bill.

Centropus bengalensis javanicus (DUM.).

Krakatau. — 1 ♀, 9.4.34, M.

Verlaten I. — 1 ♀, 26.9.20, S.

Birds from Sumatra and Java seem alike.

Chalcites basalis (HORSF.). (*Chalcococcyx basalis*, D.).

Sebesy. — 1 ♀, 28.4.21, S.

A migrant.

PICIDAE.

Dryobates moluccensis moluccensis (GMEL.). (*Iyngipicus auritus*, D.).

Krakatau. — 1 ex. 12.11.32, M.; 1 ♂, 8.1.33, D.

Verlaten I. — ♂, 11.11.32, M.; 1 ♂, 5.1.33, D.; 1 ♀, 6.1.33, D.

Sebesy. — 1 ♂, 23.4.21, D.; 1 ♂, 28.4.21, D.

Common to Sumatra and Java.

MUSCICAPIDAE.

Cyornis rufigastra rhizophorae STRES. (*Siphia* spec., D.).

Krakatau. — 1 ♂, 4.5.29, D.; 1 ♂, 1 ♀, 23.8.30, D.; 1 ♂, 1 ♀, 10.11.32, M.; 1 ♂, 12.11.32, M.; 1 ♂, 1 ♀, 7.1.33, D.; 1 ♂, 8.1.33, D.; 1 ♀, 29.4.33, D.; 1 ♂, 18.10.33, D.; 2 ♀, 6.4.34, M.; 1 ♀, 9.4.34, M.

Verlaten I. — 1 ♂ juv., 24.8.30, D.; 1 ♀, 30.4.33, D.

Sebesy. — 1 ♂, 1 ♀, 22.4.21, S.; 1 ♂, 2 ♀, 24.4.21, S.; 1 ♂, 25.4.21, S.

Lang I. — 1 ♂, 1 ♀, 9.11.32, M.

The juvenile from Verlaten I. is little more than a nestling and must have been bred on the island.

The Javan, not the Sumatran, race.

Gerygone fusca sulphurea Wall.

Krakatau. — 2 ♂, 1 ex., 10.11.32, D. and M.; 1 ♀, 29.4.33, D.; 1 ♀, 18.10.33, D.; 1 ♂, 8.4.34, M.

Verlaten I. — 1 ♂, 11.11.32, D.; 1 ♀, 5.1.33, D.; 1 ♂, 30.4.33, D.; 1 ♀, 16.10.33, D.; 1 ♀, 10.12.33, M.

This race occurs in both Sumatra and West Java.

Alseonax latirostris latirostris (Raffles).

Verlaten I. — 1 ♂, 11.11.32, D.

A migrant.

Zanthopygia narcissina zanthopygia (Hay).

Krakatau. — 1 ♂, 10.11. 32, D.

A migrant.

CAMPEPHAGIDAE.

Lalage nigra nigra (Forst.). (*Lalage terat,* D.).

Krakatau. — 1 ♂, 7.4.34, D.

Verlaten I. — 1 ♂ (? ♀), 6.1.33,D.; 1 ♂, 10.12.33, D.

This race occurs in both South Sumatra and West Java.

PYCNONOTIDAE.

Pycnonotus goiavier personatus (Hume). (*Pycnonotus analis,* D.).

Krakatau. — 1 ♂, 7.1.33, D.; 1 ♂, 1 ♀, 8.1.33, D.; 1 ♀, 7.4.34, M.

Verlaten I. — 1 ex., 2.5.29, D.; 1 ex., 3.5.29, D.; 1 juv. ♂, 16.10.33, D.

Sebesy. — 1 ♂, 22.4.21, S.

When birds from Sumatra (*personatus*) are compared with others from Central and East Java (*analis*) a difference is at once obvious: the former have whiter superciliaries and ear-coverts. The distinction, however, is less noticeable when *personatus* is compared with material from West Java and in a minority of cases I can make no separation. The Krakatau-group series includes some very white-headed birds such as seem never to occur in Java and is therefore referred to the Sumatran race.

The juvenile from Verlaten I. must have been bred locally.

TURDIDAE.

Copsychus saularis musicus Raffles.

Krakatau. — 1 ♂, 1 ♀, 9.4.34, M.

Verlaten I. — 1 ♀, 12.12.33, M.

The Sumatran, not the West Javan, subspecies.

Kittacincla malabarica tricolor (VIEILL.).

Sebesy. — 1 ♂, 1 ♀, 28.4.21, S.

Birds from South Sumatra and West Java seem inseparable.

Geokichla interpres interpres (TEMM.).

Sebesy. — 1 ♀, 22.4.21, S.

It has not yet been demonstrated that Sumatran birds differ from Javan topotypes.

SYLVIIDAE.

Orthotomus sepium ruficeps (LESS.). (*Orthotomus* spec., D.).

Sebesy. — 1 ♂, 24.4.21, S.

The Sumatran subspecies. The Javan form occurs on Meeuwen Island.

Phylloscopus borealis borealis (BLAS.).

Sebesy. — 1 ♂, 1 ♀, 25, 29.4.21, D. and S.

A migrant.

Acrocephalus stentoreus orientalis (TEMM. & SCHLEG.).

Krakatau. — 1 ♂ 8.4.34, D.

A migrant.

LANIIDAE.

Lanius cristatus superciliosus LATH.

Krakatau. — 2 ♂, 25.9.20, S.

A migrant.

Pachycephala cinerea butaloides STRES. (*Pachycephala grisola,* D.).

Krakatau. — 1 ♂, 23.9.20, S.; 1 ♀, 21.7.24, D.; 1 ♂, 1 ♀, 10.11.32, M.; 1 ☿, 8.1.33, D.; 2 ♀, 18.10.33, D.; 1 ♀, 7.4.34, M.; 1 ♂, 9.4.34, M.

Verlaten I. — 1 ♀, 26.9.20, S.; 1 ♂, 26.4.21, S.; 1 ♂, 5.1.33, D.; 1 ♂, 11.12.33, M.

Sebesy. — 1 ♂, 21.4.21, D.

The subspecies *butaloides* was described from West Java, but it is widely spread in Malaysia also occurring in Sumatra.

ARTAMIDAE.

Artamus leucorhynchus amydrus OBERH.

Krakatau. — 1 ♂, 1.5.33, D.

Verlaten I. — 1 ex., 2.5.29, D.

The species occurs in the same form in Sumatra and Java.

DICAEIDAE.

Dicaeum trigonostigmum flaviclune HART.

Krakatau. — 1 ♀, 29.4.33, D.; 1 ♂, 1.5.33, D.; 1 ♂, 6.4.34, M.

Verlaten I. — 1 ♂, 26.4.21, S.

Clearly belonging to the Javan subspecies and not to the much more brightly coloured typical form which inhabits Sumatra (*terr. typ.*, Malacca).

The collection also contains a male from Sebesy (28.4.21, S.), but it is too young for subspecific identification which is most unfortunate as an exact identification of this skin would have been one of the most interesting in the collection. It is not improbably an example of the typical form.

NECTARINIIDAE.

Leptocoma jugularis microleuca (OBERH.). (*Cinnyris pectoralis,* D.).

Krakatau. — 1 ♂, 28.4.33, D.; 1 ♀, 6.4.34, D.; 1 ♂, 8.4.34, M.

Verlaten I. — 1 ♀, 27.9.20, S.; 1 ♂, 6.1.33, D.; 1 ♀, 9.12.33, M.; 2 ♂, 11. 12.33, M.

Sebesy. — 1 ♂, 24.4.21, S.

Lang I. — 1 ♂, 1 ♀, 9.11.32, M.

In their published papers Messrs ROBINSON and KLOSS always regarded Sumatran birds of this species as inseparable from the Javan subspecies (*pectoralis*) and indeed birds from all over Malaysia are so much alike that with the exception of the northern *flammaxillaris* (Tenasserim), (regarded by some authors as a full species) any further subdivision is speculative. I have, however, in my "Handlist" confined *pectoralis* to the Javan province and used *microleuca* (*terr. typ.,* Taya Island, South-east Sumatra) for all Malaysian birds from non-Javan localities because they usually have rather more robust bills than topotypes of *pectoralis*, but the difference is by no means constant and *microleuca* is a very poor race.

From Krakatau and the other small islands under consideration at present four adult males with undamaged bills are available for comparison. The shortest bill in this small series is just longer than the bill in any of five out of six adult males from Java and the birds from the Krakatau islets therefore seem best referred to the non-Javan subspecies.

Anthreptes malacensis malacensis (SCOP.).

Krakatau. — 1 ♂ juv., 21.7.24, D.

Verlaten I. — 1 ♂, 11.12.33, M.; 1 ♂ imm., 9.12.33, M.

Sebesy. — 1 ♂ imm., 1 ♀, 21.4.21, D.; 1 ♂, 24.4.21, D.; 1 ♀, 29.4.21, D.

Common to both Java and Sumatra.

Arachnothera longirostra longirostra (LATH.).

Sebesy. — 1 ex., 21.4.21, D.

Definitely of the typical race (*terr. typ.,* Bengal) which occurs in South Sumatra. In West Java a very distinct form (*prillwitzi* HART.), is found.

MOTACILLIDAE.

Motacilla flava simillima HART.

Krakatau. — 1 ♂, 25.9.20, S.

A migrant.

Motacilla cinerea melanope PALL.

Sebesy. — 1 ♂, 29.9.20, S.

A migrant.

PLOCEIDAE.

Munia punctulata fretensis KLOSS. (*M. nisoria*, D.).

Sebesy. — 1 ad., 1 imm., both unsexed, 29.4.21, S.

The immature bird is too young to identify subspecifically with any degree of certainty, but the adult belongs to the race inhabiting Sumatra, where it is found in the Lampongs (*terr. typ.*, Selangor, Malay States) and not to the Javan form.

GRACULIDAE.

Aplonis panayensis strigatus (HORSF.). (*Calornis chalybea*, D.).

Krakatau. — 1 ♂, 22.9.20, S.; 1 ♀, -.7.24, D.; 1 ♂, 12.11.32, M.; 1 ♂, 1 ♀, 29.4.33, D. Wings, ♂ 95, 99, 95, 99; ♀, 92 mm.

Verlaten I. — 2 ♂, 5.1.33, D. M.; 1 ♂, 30.4.33, D.; 1 ♀, 8.12.33, M. Wings, ♂, 97, 101, 99; ♀, 95 mm.

Sebesy. — 2 ♀, 25.4.21, S. Wings. 89, 96 mm.

Birds from South Sumatra and West Java seem to be exactly alike.

ORIOLIDAE.

Oriolus chinensis maculatus VIEILL.

Krakatau. — 2 ♂, 22.9.20, S.; 1 ♂, 1 ♀, 21.7.24, D.; 1 ♂, 22.7.24, S.; 1 ex. 4.5.29, D.; 2 ♂, 7, 8.1.33, D.

Verlaten I. — 1 ♂, 26.4.21, S.

Sebesy. — 1 ♀, 22.4.21, S.

Sumatran and Javan birds are always referred to the same race, *maculatus* (*terr. typ.*, Java) and a slightly larger average size of the bill in Sumatran specimens is the only distinction I can detect in a re-examination of the available material. Measured from the anterior point of the nostril the bills of topotypical males from Java measure 20.4 - 22.4 against 21.1 - 24 mm in Sumatran males. Females give 20 - 21.4 against 21.5 - 22 mm. The adult Krakatau birds together with a male from Verlaten and a female from Sebesy give 22.2 - 23.1 mm for males and 21.5 - 23.3 mm for females. The distinctions are not great (the short, but certain, measurement given tends to minimize the difference, but in the skins the more robust bills of some of the Sumatran birds are very noticeable), and on the material, I should not care to separate a Sumatran race, but there is at least a suggestion here that the birds under notice come from the Sumatran stock.

One of the males (21st July) from Krakatau is very young and retains traces of the juvenile plumage; it is, however, full grown and could, I should say, have crossed from the mainland.

CORVIDAE.

Corvus macrorhynchos macrorhynchos WAGL.

Krakatau. — 1 ♂, 25.9.20, S.

Verlaten I. — 1 ♂, 26.4.21, S.

The species occurs in the same form in the lowlands of Sumatra and West Java.

A SUMMARY OF THE AVIFAUNA OF KRAKATAU, VERLATEN ISLAND, LANG ISLAND AND SEBESY.

The + crosses represent the increase in knowledge during the period 1924 - 1934.

Name	Distribution				Status										Dates			Remarks
					Resident Land Birds			Breeding				Other Birds						
	Krakatau	Verlaten Island	Lang Island	Sebesy	Sumatra and Java	Sumatra	Java	Krakatau	Verlaten Island	Lang Island	Sebesy	Migrants	Widely-spread sea birds	Coastal birds and wanderers	1908	1919 – 21	1924 – 34	
COLUMBIDAE																		
Treron vernans griseicapilla SCHLEG.	×	×		×	×										×	×	×	*Osmotreron vernans*, D.
Myristicivora b. bicolor SCOP.	×	×		×										×		×		
Macropygia phasianella emiliana BP.		+			×												+	
Geopelia s. striata L.	×				×											×		
Chalcophaps i. indica L.	×	×		×	×			×	×		×				×	×	×	
RALLIDAE																		
Amaurornis phôenicurus javanica HORSF.	×	×		×	×				×							×	×	
BURHINIDAE																		
Esacus magnirostris scommophorus OBERH.		×		×										×		×		
CHARADRIIDAE																		
Charadrius apricarius fulvus GMEL.		+										×					+	
Charadrius l. leschenaultii LESS.		×		×								×				×		*Ochthodromus geoffroyi*, D.
SCOLOPACIDAE																		
Arenaria i. interpres. L.		+										×					+	
Numenius phaeopus variegatus SCOP.	×			×								×				×		
Tringa hypoleucos L.	×	×		×								×			×	×	×	
Tringa nebularia GUNN.		+										×					+	
LARIDAE																		
Chlidonias leucoptera grisea HORSF.	×	×											×			×		*Hydrochelidon leucoptera*, D.
Sterna bergii cristata STEPH.		×											×			×		
Sterna dougallii bangsi MATHS.		×											×		×	×		A species of *Sterna* breeds on Verlaten (1919).

Name	Distribution: Krakatau	Distribution: Verlaten Island	Distribution: Lang Island	Distribution: Sebesy	Status: Resident Land Birds: Sumatra and Java	Status: Resident Land Birds: Sumatra	Status: Resident Land Birds: Java	Status: Breeding: Krakatau	Status: Breeding: Verlaten Island	Status: Breeding: Lang Island	Status: Breeding: Sebesy	Status: Other Birds: Migrants	Status: Other Birds: Widely-spread sea birds	Status: Other Birds: Coastal birds and wanderers	Dates: 1908	Dates: 1919 – 21	Dates: 1924 – 34	Remarks
Sterna s. sumatrana RAFF.		×		×									×		×	×		*S. melanauchen*, D.
Sterna ? anaethetus SCOP.		×											×			×		perhaps *S. fuliginosa*.
HYDROBATIDAE																		
Oceanodroma leucorhoa monorhis SWINH.		×											×			×		
ARDEIDAE																		
Demigretta s. sacra GMEL.	×			×										×		×		
Butorides striatus SUBSP.	×													×		×		? *javanicus* (resident). ? *amurensis* (migrant);
FREGATIDAE																		
Fregata SP.	×			×									×			×		
FALCONIDAE																		
Accipiter SP. . : . . .	×											×				×		
Haliaeetus leucogaster GMEL.	×	×		×										×		×		
Haliastur indus intermedius GURN.	×	×		×										×		×		
ALCEDINIDAE																		
Halcyon chloris cyanescens OBERH.	×	×		×				×						×	×	×	×	
Alcedo atthis bengalensis GMEL.		+												×			+	
Alcedo coerulescens VIEILL.	×						×								×			*A. beryllina*, D.
CAPRIMULGIDAE																		
Caprimulgus a. affinis HORSF.	×	×		×	×			?	?						×	×	×	oviduct eggs.
MICROPODIDAE																		
Micropus Sp.		×												×		×		
Collocalia Sp.	×	×		×										×	×	×		
CUCULIDAE																		
Cacomantis merulinus SUBSP.				×		?	?									×		Subspecies undetermined.

Name	Distribution				Status: Resident Land Birds			Status: Breeding				Status: Other Birds			Dates			Remarks
	Krakatau	Verlaten Island	Lang Island	Sebesy	Sumatra and Java	Sumatra	Java	Krakatau	Verlaten Island	Lang Island	Sebesy	Migrants	Widely-spread sea birds	Coastal birds and wanderers	1908	1919 — 21	1924 — 34	
Eudynamys scolopaceus malayanus CAB. & HEIN.	×	×		×	×											×	×	*E. honorata*, D.
Centropus sinensis curycercus HAY.		×		×		×										×		No bird examined from Verlaten.
Centropus bengalensis javanicus DUM.	×	×		×	×			×							×	×	×	
Chalcites basalis HORSF.				×								×				×		
PICIDAE																		
Dryobates m. moluccensis GMEL.	×	+		×	×											×	×	
HIRUNDINIDAE																		
Hirundo rustica gutturalis SCOP.	×	×										×				×		
Hirundo tahitica javanica SP.	×	×		×	×											×		
MUSCICAPIDAE																		
Cyornis rufigastra rhizophorae STRES.	+	+	+	×			×		+							×	×	*Siphia* spec., D.
Gerygone fusca sulphurea WALL.	+	+			×												+	
Alseonax l. latirostris RAFF.		+										×					+	
Zanthopygia narcissina zanthopygia HAY.		+										×					+	
CAMPEPHAGIDAE																		
Lalage n. nigra FORST.	×	×		×	×											×	×	
PYCNONOTIDAE																		
Pycnonotus goiavier personatus HUME.	×	×		×		×			+		×				×	×	×	
Pycnonotus a. aurigaster VIEILL.	×						×								×			
TURDIDAE																		
Copsychus saularis musicus RAFF.	×	×				×										×	×	

Name	Distribution				Status										Dates			Remarks
					Resident Land Birds			Breeding				Other Birds						
	Krakatau	Verlaten Island	Lang Island	Sebesy	Sumatra and Java	Sumatra	Java	Krakatau	Verlaten Island	Lang Island	Sebesy	Migrants	Widely-spread sea birds	Coastal birds and wanderers	1908	1919 — 21	1924 — 34	
Kittacincla malabarica tricolor VIEILL.				×	×											×		
Geokichla interpres TEMM.				×	×											×		
SYLVIIDAE																		
Orthotomus sepium ruficeps LESS.				×		×										×		*cineraceus* auct.
Phylloscopus b. borealis BLAS.				×								×				×		
Acrocephalus stentoreus orientalis T. + S.	+											×					+	
ARTAMIDAE																		
Artamus leucorhynchus amydrus OBERH.	×	×		×	×										×	×	×	
LANIIDAE																		
Lanius cristatus superciliosus LATH.	×											×				×		
Lanius schach bentet HORSF.	×	×			×			×	×						×	×		
Pachycephala cinerea butaloides STRES.	×	×		×	×											×	×	*Pachycephala grisola*, D.
DICAEIDAE																		
Dicaeum trigonostigmum flaviclune HART.	×	×		?			×									×	×	Subspecies on Sebesy uncertain.
NECTARINIIDAE																		
Leptocoma jugularis microleuca OBERH.	×	×	+	×		×			×							×	×	*Cinnyris pectoralis*, D.
Anthreptes m. malacensis SCOP.	×	×		×	×											×	×	
Arachnothera l. longirostris LATH.				×		×										×		

Name	Distribution				Status										Dates			Remarks
					Resident Land Birds			Breeding				Other Birds						
	Krakatau	Verlaten Island	Lang Island	Sebesy	Sumatra and Java	Sumatra	Java	Krakatau	Verlaten Island	Lang Island	Sebesy	Migrants	Widely-spread sea birds	Coastal birds and wanderers	1908	1919 — 21	1924 — 34	
MOTACILLIDAE																		
Motacilla flava simillima HART.	×	×										×				×		
Motacilla cinerea melanope PALL.				×								×				×		
PLOCEIDAE																		
Munia punctulata fretensis KL.				×		×										×		*M nisoria*, D.
GRACULIDAE																		
Aplonis panayensis strigatus HORSF.	×	×		×	×				×							×	×	
ORIOLIDAE																		
Oriolus chinensis maculatus VIEILL.	×	×		×	×			×							×	×	×	
CORVIDAE																		
Corvus m. macrorhynchos WAGL.	×	×		×	×										×	×		

DESCRIPTIONS AND RECORDS OF ORIENTAL AND PAPUAN SOLITARY VESPIDAE (HYM.).

By

Dr. J. VAN DER VECHT

(Buitenzorg, Java).

During my leave in Europe in 1933-'34, I had an opportunity to examine the types of various Oriental and Australian Vespidae in the British Museum at London, the University Museum at Oxford, and the Museums at Leiden and Amsterdam. As is well known among the students of Hymenoptera, our knowledge of the representatives of the order in this part of the world is still very incomplete. This may be partly due to the fact that many of the species are local or rare, but the study is especially complicated by the inadequate work of some of the previous authors, viz. F. Smith and P. Cameron, whose descriptions are as a rule so short or inexact, that it is often impossible to recognize their species from the descriptions alone. Most of the types of these authors have never been redescribed and I was therefore very glad to have the opportunity of studying these valuable insects.

In the present paper I have accepted the generic definitions as given by J. Bequaert in his excellent paper on the Vespidae of the Belgian Congo (Bull. Am. Mus. Nat. Hist. XXXIX, 1918, pp. 1 - 384). This includes the suppression of *Rygchium* as a separate genus and the acceptance of *Pachymenes* and *Ancistrocerus* as distinct genera. In *Pachymenes* are brought together a few species in which the shape of the abdomen is intermediate between that of *Eumenes* and of *Odynerus;* their first abdominal tergite has no trace of a transverse carina. *Ancistrocerus* contains the species with a transverse carina or suture on the first tergite [1]).

I am convinced that this classification is very unsatisfactory from a phylogenetic point of view, because each of the genera thus defined contains species, which are in many respects very closely allied to one or more species of the other genera. However, any attempt to arrange the Oriental *Odynerus*-like wasps in more natural groups would probably result in a failure, in view of our very imperfect present knowledge of these insects. Moreover a revision of the generic and subgeneric divisions of the solitary Vespidae can hardly be undertaken for a single region, many groups of apparently closely allied species being represented in various parts of the world.

[1]) The genus *Nortonia*, which differs from *Ancistrocerus* mainly in having the first abdominal segment narrowed as in *Pachymenes*, is not treated in this paper.

The following notes and descriptions must therefore be merely regarded as an attempt to contribute to the knowledge of various species and varieties, which up to the present were confused with others, incompletely described or entirely unknown.

For the interpretation of the terms "holotype, allotype and paratype" I refer to J. BEQUAERT, by whom this subject was fully discussed in Ann. Mag. Nat. Hist. (10), II, 1928, pp. 139 - 140.

The "!" before the literature references indicates that I have examined the type(s) (in case of new species) or other specimens on which the authors based descriptions or records.

I wish to acknowledge my indebtedness to the authorities of the above mentioned Museums, for their kindness in allowing me to study their collections. I am under special obligation to the "Bachiene Stichting" which enabled me to visit London and Oxford by a financial contribution to the cost of this trip. Furthermore, I wish to thank Prof. G. D. HALE CARPENTER of Oxford, who permitted me to borrow from the collection of the Oxford University Museum a number of Vespidae, which I compared with types of SMITH and CAMERON during my visit.

Prof. J. BEQUAERT, Boston, obliged me very much by sending me some critical notes on my preliminary description of the new genus *Nortozumia*.

I am much indebted to Mr. H. T. PAGDEN, Department of Agriculture, Kuala Lumpur, for going through the manuscript of this paper.

Calligaster SAUSS.

Calligaster cyanopterus SAUSS.

! 1852. SAUSSURE, H. DE, Ét. fam. Vesp. I, p. 23, pl. IX, fig. 7, ♀ (*Calligaster cyanoptera*, Java).

1891. GRIBODO, G., Bull. Soc. Ent. Ital. 23, p. 261, ♂ (*Calligaster javanus*, Java or., Kalipare).

In my opinion GRIBODO's species is undoubtedly conspecific with *C. cyanopterus,* of which I examined the holotype (♀, Java, CALKOEN leg.) in the Museum at Leiden. That GRIBODO did not recognize his specimen as a ♂ of *cyanopterus* may be due to the fact that the shape of the clypeus is very different in the two sexes: the anterior margin is transverse in the female, but deeply emarginate in the male. Furthermore GRIBODO compared his specimen with a female from Sumatra, the wings of which are said to be cupreous, but this latter specimen was certainly not a typical *cyanopterus,* for in the Javan specimens the wings have always a bluish iridescence.

Up to the present *C. cyanopterus* is the only species of *Calligaster* known to occur in Java. Other Oriental species have been described from India and Borneo, and in my collection I have an unidentified species from Celebes.

The Philippine species, of which the life history was described by F. X. WILLIAMS (Bull. Hawaii. Sugar Pl. Ass., no. 14, 1919, "*Calligaster cyanopterus*"),

is not conspecific with *C. cyanopterus.* It will be described in a forthcoming paper by Prof. J. Bequaert.

In Java *Calligaster cyanopterus* Sauss. is not rare in the forests. It occurs in the plains as well as in the mountains, but apparently not above an altitude of about 1000 m. I have seen specimens from the following localities: Djasinga (150 m); Mt. Gedeh, Tjiboenar (900 m); Djampang, Mt. Tjimerang (6 - 800 m); Pelaboean Ratoe (20 m); Mt. Limboeng (900 m); Penandjoeng Bay, Kalipoetjang (200 m); Linggerdjati (Mt. Tjareme); Mt. Slamat, Batoerraden (800 m) (all in Mus. Buitenzorg). — Mt. Gedeh, Tapos (800 m), author; Djampang Tengah, Mt. Tjisoeroe (600 - 800 m), Mrs. M. E. Walsh; S. Banjoemas, Koebangkangkoeng (25 m), F. C. Drescher; Mt. Raoeng, Bajoekidoel (450 - 700 m), H. Lucht, (all in my collection). — The species may be found throughout the year.

Nortozumia, new genus.

Head much swollen behind the eyes, the posterior ocelli at least twice as far from the occiput as from the eyes. Mandibles moderately elongate and narrower than is usual in the Zethinae, somewhat knife-like, strongly grooved on the outer surface; their apices decussate when closed, the cutting edge long, very oblique, with broad, blunt teeth (fig. 1, c and d). Labial palpi 4-jointed. Maxillary palpi 6-jointed. Clypeus transverse, truncate and toothed at apex. Antennae 12-jointed in ♀, 13-jointed in ♂; apical segment in ♂ hook-like and folded back. Thorax somewhat depressed. Mesopleura with epicnemial carina. Propodeum: concavity rather narrow, limited by carinae on the sides, separated from the postscutellum by the contiguous median portions of the dorsal areas; dorsal and ventral lateral areas separated by a carina which ends in a transverse, raised lamella close to the articular valvulae. First abdominal segment stalk-like, moderately swollen, ovate with a much narrower basal portion; the tergite with a transverse crest close to the base, behind the articular slit; spiracular tubercles prominent. Second segment slightly narrowed basally, but not stalk-like. Mid tibiae with one spur. Claws bifid. Second cubital cell triangular, the two intercubital veins narrowly separated on the radius; the lower margin nearly straight, receiving the first recurrent at an acute angle before the middle and the second recurrent close to the second intercubitus (fig. 2 c).

Genotype: *Zethus rufofemoratus* P. Cameron (1903).

As Prof. J. Bequaert kindly pointed out to me, the generic and subgeneric concepts in the Zethinae are at present in the utmost confusion. It is therefore difficult to say, whether *Nortozumia,* which, also in Bequaert's opinion, appears to be a natural group, will be regarded in the future as a genus, or as a subgenus of *Discoelius,* which is apparently its nearest ally. *Nortozumia* differs from the genotype of *Discoelius* (*zonalis* Panz.) in the shape of the mandibles, the course of the first recurrent vein, the presence of only one spur on the mid tibiae

and in having a transverse crest at the base of the first tergite. Soms of these differences are of minor importance, but unless the limits of the genera in the Zethinae are better defined than at present, I think it advisable to give *Nortozumia* generic rank.

Nortozumia rufofemorata (CAM.) (fig. 1, a-g).

! 1903. CAMERON, P., Jl. Straits Br. As. Soc. 39, p. 165, ♀ (*Zethus rufofemoratus*, Sarawak, Kuching).

? 1910. MEADE-WALDO, G., Ann. Mag. Nat. Hist. (8), 5, p. 47 (*Montezumia pulchella* SMITH = *Gayella pulchella* SMITH).

! 1914. MEADE-WALDO, G., Ann. Mag. Nat. Hist. (8), 14, p. 404 (*Montezumia pulchella* SM. = *Zethus rufofemoratus* CAM.).

MEADE-WALDO's opinion (1914) upon the identity of "*Montezumia pulchella* SMITH" and "*Zethus rufofemoratus* CAM." has apparently been based upon a "cotype" of the former species in the British Museum. Unfortunately, this specimen does not belong to the same species as the holotype in Oxford, and as SMITH's description leaves no doubt that the latter specimen is correctly regarded as the true type, *rufofemoratus* cannot be a synonym of *pulchella*. MEADE-WALDO's earlier note on *Montezumia pulchella* was probably based upon the same specimen in the British Museum.

♀ - Clypeus (fig. 1a) 1⅓ times as wide as long (including the teeth), contiguous with the eyes over a short distance only. Inter-antennal shield with longitudinal median carina; front with a shallow impression below the middle.

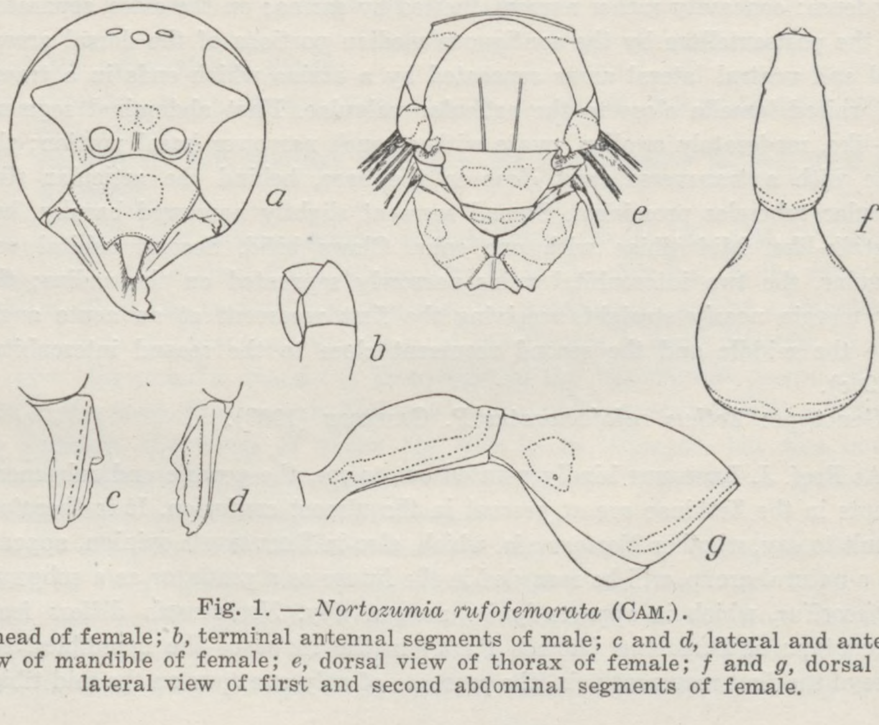


Fig. 1. — *Nortozumia rufofemorata* (CAM.).
a, head of female; *b*, terminal antennal segments of male; *c* and *d*, lateral and anterior view of mandible of female; *e*, dorsal view of thorax of female; *f* and *g*, dorsal and lateral view of first and second abdominal segments of female.

Ocelli placed in a flattened triangle, the posterior ocelli almost as far from the eyes as from each other and three times as far from the occiput as from the eyes. Inner orbits a trifle further apart on the vertex than at the clypeus. Third antennal segment $1\frac{1}{2}$ times as long as wide at the apex, distinctly longer than the fourth segment which is approximately square in outline.

Thorax as wide as the head, pronotum narrowed anteriorly, the anterior margin distinctly carinate, the lateral angles rounded, not projecting. Mesonotum with distinct parapsidal furrows. Anterior margin of scutellum depressed, crenulate. Propodeum with a short, irregular, median furrow at the base, the narrow concavity with a median longitudinal carina.

Abdomen: figs. 1f and 1g; first tergite with a rather deep transverse impression in front of the yellow apical fascia, the apical margin thin, slightly depressed; the first sternite with a broad longitudinal carina in the middle and two longitudinal grooves on each side of it.

Head and thorax faintly shining; puncturation of the head moderately coarse, rather sparse in the centre of the clypeus, very dense on the frons, reticulate in the median impression of the frons, much sparser on the vertex where most of the interspaces are larger than the punctures; temples slightly more coarsely and densely punctate than the vertex. Pronotum, anterior portion of mesonotum, and the postscutellum densely, reticulately punctate; puncturation of mesopleura coarser, but not less dense; the posterior portion of the mesonotum and the scutellum more sparsely punctate. Metapleura and ventral lateral area of propodeum coarsely, but rather regularly, longitudinally striate; the dorsal lateral areas densely punctate, with a median, impunctate area, separated from the lateral carina by a row of short transverse ridges; concavity dull, finely sculptured. — Abdomen rather shining. First tergite densely covered with medium-sized well defined punctures, more sparsely punctate medially, posterior to the transverse ridge, the narrow apical margin almost impunctate. Second tergite scarcely less densely punctate, but the punctures more superficial and ill defined; there is a conspicuous transverse row of punctures at the base of the narrow, depressed, apical margin; puncturation of third and fourth tergites dense, coarser in the middle than at the sides, their impunctate apical margins rather wide; fifth and sixth tergites impunctate, with microscopically fine sculpture. Second and following sternites punctate like the corresponding tergites, but the punctures finer and sparser.

Black; marked with yellow as follows: clypeus (except for one or two black marks in the centre), the first antennal segment beneath, a spot above the inter-antennal shield, a short and narrow line along the inner orbits near the antennae, a line on the temples, a transverse fascia on the anterior margin of the pronotum, a spot on the mesopleura below the tegulae, the posttegulae, two (rather small) spots on the scutellum, a transverse line on the postscutellum (interrupted in the middle); on the dorsal lateral areas of the propodeum: a spot at the base and a broad oblique line at the posterior margin, running from the top of the concavity towards the apex; a U-shaped line along the

lateral and posterior margins of the first tergite, commencing in front of the stigmata, and slightly interrupted posteriorly in the middle; an irregular lateral spot on each side of the base of the second tergite, and a rather narrow preapical fascia, very narrowly interrupted in the middle, on this tergite; longitudinal yellow spots on the outer side of femora I and tibiae I and II, a small spot close to the apex of femora II and a minute spot at the apex of femora III. Apical half of the mandibles dark reddish; the median portion of the tegulae and the depressed apical margin of the first tergite brown; articular valvulae of propodeum, coxae, trochanters and femora of mid and hind legs ferruginous; the remainder of the legs (except for the yellow markings) brownish or black, the apical tarsal joints ferruginous. Wings brownish hyaline with yellow and purplish reflections, darker along the anterior margin, especially in the apex of the median cell, in the radial cell and the second, third and fourth cubital cells.

♂ - Smaller; the clypeus narrower than in the female, the apex scarcely more deeply emarginate; the eyes distinctly further apart on the vertex than at the clypeus (15 : 11). Third antennal segment almost twice as long as wide at the apex, slightly longer than the fourth segment; twelfth segment short and narrow; the last segment narrow, slightly curved, tapering towards the end, distinctly reaching over the base of the eleventh segment (fig. 1b). Thorax as in the female. The seventh abdominal sternite flattened, rounded at the apex.

Puncturation as in the female; the coloration of one of the two males before me differs from that of the female as follows: clypeus entirely yellow, inner orbits and temples black, femora II and III without distinct yellow markings; femora II brownish, the apex ferruginous. — In the other male specimen the scutellum is entirely black, the dorsal lateral areas have no spot at the base and the spots at the base of the second tergite are absent.

Length (h. + th. + t. 1 + 2), ♀: 14 - 15 mm, ♂: 11 - 12 mm.

Described from 1 ♀ and 2 ♂♂ from Borneo, Sarawak, Kuching (R. SHELFORD) in the Oxford University Museum (nrs. 1900: 11191 (♀), 11180 and 11206 (♂♂)). The first described male specimen is herewith designated as the allotype of this species; in 1934 I studied the holotype in the British Museum and compared it with the specimens described above.

Nortozumia pulchella (SM.) (fig. 2, a-c).

! 1858. SMITH, F., Jl. Proc. Linn. Soc. Zool. II, p. 108, ♀ (*Gayella pulchella*, Borneo, Sarawak).

! 1902. CAMERON, P., Jl. Straits Br. As. Soc. 37, p. 109, ♀ (*Montezumia? forticeps*, Borneo, Sarawak, Mt. Matang).

Very closely allied to the preceding species, but easily distinguished from it by the shape of the clypeus, the apex of which is in both sexes more deeply emarginate (fig. 2a). The last antennal segment of the male is shorter and does not reach the base of the eleventh segment (fig. 2b). The scutellum appears to have a more distinct median impressed line.

The present species is more richly marked with yellow than *N. rufofemorata*: clypeus in both sexes entirely yellow; vertex with two oblique yellow lines, running from the centre of the vertex towards the top of the eyes; mesonotum with two yellow lines (♀) or black (♂), scutellum with large, almost square, spots; dorsal lateral areas of propodeum nearly entirely yellow; third and fourth abdominal tergites with a preapical fascia; the remainder as in *N. rufofemorata*.

SMITH's description is not very exact: the labrum and mandibles are not yellow, but the former is ferruginous, the latter are dark ferruginous, black at base and apex; furthermore SMITH's remarks upon the yellow abdominal fasciae are incorrect, because he did not regard the petiole as the first abdominal segment.

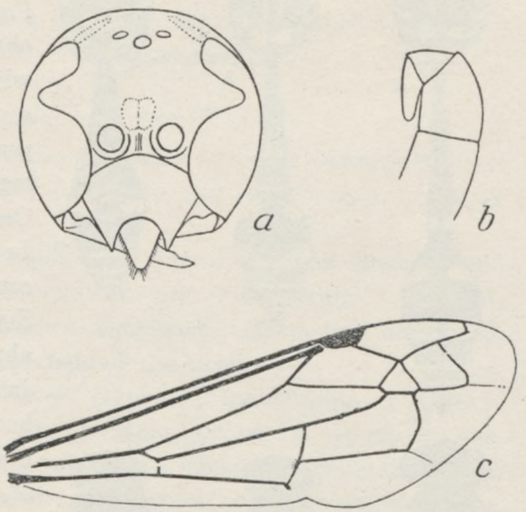


Fig. 2. — *Nortozumia pulchella* (SM.). *a*, head of male; *b*, terminal antennal segments of male; *c*, fore wing of male.

I studied a male of this species, herewith designated as the allotype, from N.W. Borneo, Sarawak, Mt. Matang (3600′), R. SHELFORD, in the collection of the Oxford University Museum (no. 1900, 11190); in 1934 I compared that specimen with the holotype in the same Museum.

Pareumenes SAUSS.

The genus *Pareumenes* is well represented in the East Indian Archipelago, but most species are rare, and some of them have been described under other generic names. SOIKA (1935) gave valuable descriptions of some of SMITH's "*Eumenes*"-species, which really belong to this genus, and in the following pages all the *Pareumenes*-species of the Archipelago are listed, a few species described by other workers under *Eumenes* and *Pterochilus* have been incorporated in this genus and some varieties of known species are described here for the first time.

The Indian species *P. brevirostratus* SAUSS., *indianus* SAUSS. and *rufopetiolatus* WICKW., and the Chinese *P. imperatrix* (SM.) are omitted from this list, as these forms are insufficiently known to me.

Heterochromy and homeochromy.

In his excellent paper on the colour forms of the Oriental hornets *Vespa tropica* and *V. affinis* (Treubia 15, pp. 329 - 352, 1936), BEQUAERT has drawn attention to the superficial resemblance in coloration (homeochromy) of colour varieties of different species, occurring in the same area.

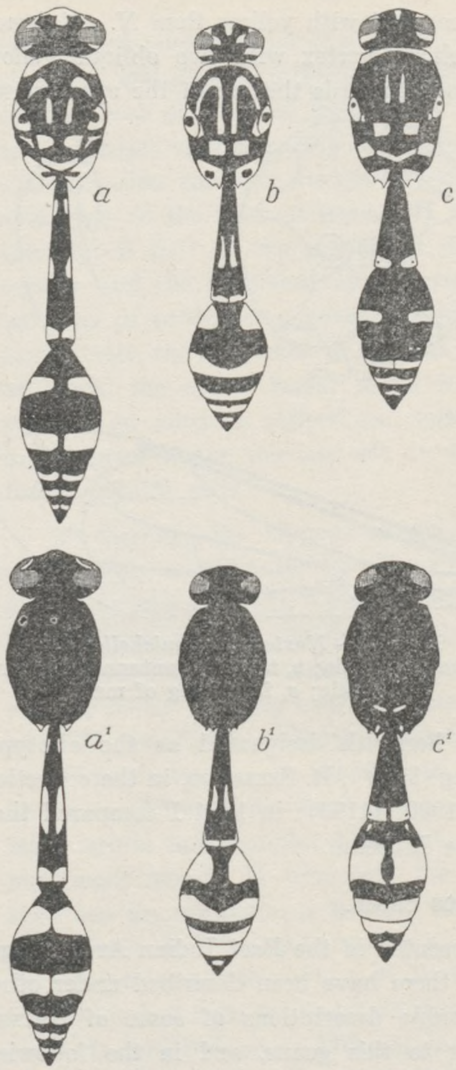


Fig. 3. — Heterochromy and homeochromy in *Eumenes* and *Pareumenes*; above: specimens from Sumatra and Borneo; below: specimens from Java.

a, *Eumenes arcuatus continentalis* Zimm., Sumatra, Borneo.
a[1], *Eumenes arcuatus blanchardi* Sauss., Java.
b, *Pareumenes depressus* Sauss., Sumatra.
b[1], *Pareumenes depressus thoracicus* m., Java.
c, *Pareumenes quadrispinosus intermedius* m., Sumatra, Borneo.
c[1], *Pareumenes quadrispinosus javanus* m., Java.

A remarkable instance of homeochromy is exhibited by some colour varieties of species of *Eumenes* and *Pareumenes*. As is well known, heterochromy is strongly developed in the wide-spread *Eumenes arcuatus*, of which several colour forms occur in various parts of the Oriental and Australian regions (Zimmermann, Zeitschr. Morph. Oek. d. Tiere 22, pp. 173 - 230, 1931). In Sumatra and Borneo this species is represented by the var. *continentalis* Zimm. [1]), which has the whole body abundantly marked with yellow; in the Javan form, var. *blanchardi* Sauss., the head and thorax are almost entirely black, but some of the yellow markings of the abdomen are larger than in the var. *continentalis*. As is shown in the accompanying figures, *Pareumenes quadrispinosus intermedius* from Sumatra and Borneo and *P. depressus* from Sumatra agree very much in coloration with the var. *continentalis* of *E. arcuatus*; the Javan forms of these two *Pareumenes*-species, described below, are homeochromic with *E. arcuatus blanchardi*. In all the Javan specimens of these species the reduction of the yellow markings of the head and the thorax is accompanied by an increase in size of the spots on the second abdominal tergite.

Further studies of the colour varieties of *Pareumenes* will certainly reveal other instances of homeochromy and will show that various *Pareumenes*-forms closely agree in coloration with certain forms of *Eumenes*. When examining specimens of *P. brevirostratus* Sauss. in the British Museum, I noted that this species resembles *E. maxillosus* F.,

[1]) This variety differs only slightly, and apparently not constantly, from the typical form and is therefore not recognized by some authors (Soika, 1935).

var. *conicus* F. from India. *P. depressus* SAUSS., var. *pictifrons* (SM.) from Celebes is homeochromic with *E. arcuatus* F., var. *fulvipennis* (SM.) from the same island, both being characterized by the almost complete reduction of the yellow markings. Similar coloration is shown by *P. pullatus* (SM.) from Ceram, a species which is closely allied to *P. depressus.*

The subgenera of Pareumenes.

The genus *Pareumenes* has recently been divided by SOIKA (Ann. Mus. Civ. Storia Nat. Genova LVII, 1935, pp. 137, 145) into two subgenera, which may be separated as follows:

First abdominal sternite triangular, its lateral margins straight, and at least part of its surface transversely striate. First tergite triangular, not distinctly swollen in its apical third. Epicnemial carina well developed. Head subcircular, vertex not raised behind the ocelli.

Pareumenes SAUSS. (type: *P. quadrispinosus* SAUSS.).

First abdominal sternite for the greater part of its length narrow, rather abruptly widened close to the apex, thus forming a triangular apical area similar to that in *Eumenes* s. str., its surface not transversely striate. Apical portion of the first tergite swollen. Epicnemial carina absent. Head higher than wide, the vertex raised behind the ocelli.

Pseumenes SOIKA (type: *P. eximius* SM.).

Subgenus **Pareumenes** SAUSS. s. str.

Pareumenes (Pareumenes) quadrispinosus SAUSS.

! 1854. SAUSSURE, H. DE, Ét. fam. Vesp. Suppl. p. 134, ♀♂, pl. VII, figs. 2, 2g. (*Pareumenes quadrispinosa*, India).
1897. BINGHAM, C. T., Fauna Br. India, Hym. I, p. 336, ♀♂ (*Eumenes quadrispinosa*, India).
? 1922. DOVER, C. & H. S. RAO, Jl. As. Soc. Bengal 18, p. 236 (*Eumenes quadrispinosa*).
? 1925. DOVER, C., Jl. As. Soc. Bengal 20 (1924), p. 296 (*Pareumenes quadrispinosa*).
1928. BEQUAERT, J., Ann. Mag. Nat. Hist. (10) II, p. 172 (*Pareumenes quadrispinosus*).
? 1931. DOVER, C., Jl. Fed. Mal. St. Mus. 16, p. 252 (*Pareumenes quadrispinosa*).

This species has been confused by some authors with *P. depressus* SAUSS. DOVER (1931) considers the latter to be a variety of *P. quadrispinosus,* which is certainly not correct, for *P. depressus* belongs to the subgenus *Pseumenes.* The insect of which PIEL (1935) studied the interesting life-history is in my opinion not *P. quadrispinosus,* but *P. depressus;* this is apparent from the figures in PIEL's paper and was moreover confirmed by the examination of a specimen determined by that investigator and kindly sent to me some time ago.

DOVER (1925) recorded *Eumenes eximius* SM. (1860) as a synonym of the present species, but I agree with SOIKA that SMITH's species is quite different and belongs to the subgenus *Pseumenes.*

In India *P. quadrispinosus* has developed some colour varieties, which have

not yet been sufficiently distinguished. In the holotype (Br. Mus., London) the petiole is ferruginous, but there are other forms with a black petiole (cf. BINGHAM, p. 337). The Indian forms, however, are all much more abundantly marked with yellow than the following two varieties from the Western part of the East-Indian Archipelago.

Pareumenes quadrispinosus SAUSS., var. **intermedius,** new variety (fig. 3c).

Female. — Black; marked with yellow as follows: clypeus; underside of first antennal segment; a line running from the anterior ocellus towards the clypeus, abruptly widened above the antennal insertions; the eye-emarginations; a line on the temples; a transverse fascia on the pronotum; two subparallel lines on the mesonotum; tegulae (except for a black spot anteriorly); post-tegulae; a large spot on the upper part of the mesopleura and a small linear spot below it; two rather widely separated spots on the scutellum; a curved line on the posterior margin of the postscutellum; spots at base and apex of the dorsal areas of the propodeum (the black space between them being T-shaped), the articular valvulae of the propodeum; a transverse fascia at the apex of the first tergite, widely interrupted in the middle and enclosing a small black spot on each side; a rather narrow transverse fascia, more widely interrupted, on the second tergite (its distance from the base about twice that from the apex); apical fasciae on the third and fourth tergites and a transverse mark in the middle of the apex of the fifth tergite; the first sternite (except for a black spot at the apex); more than the basal half of the second sternite and small spots on the posterior lateral angles of the second and third sternites.

Legs black; coxae I with a lateral line, outer side of femora I, a short line on the apical half of femora II, and broad lines on all tibiae, yellow. Wings slightly darker than in the Sumatran form of *Eumenes arcuatus* (var. *continentalis* ZIMM.).

Male. — Coloration as in the female; coxae II with a yellow lateral line; metatarsus of legs II and III with a yellow line above. Wings somewhat less dark than in the female.

Length (h. + th. + t. 1 + 2), ♀ 19 mm, ♂ 14 mm.

Holotype: ♀, Borneo, Sarawak, Kuching, R. SHELFORD, 23 Dec. 1899, coll. Oxford Mus. (no. 1900, 11189); allotype: ♂, Sumatra, Benkoelen Res., Benkoelen, Mrs. M. E. WALSH, 10 - 18 May 1935, in my collection.

Pareumenes quadrispinosus SAUSS., var. **javanus,** new variety (fig. 3 c[1]).

Differs from the preceding form in having the head and thorax almost entirely black; the markings of the abdominal tergites are however larger than in *intermedius.*

Female. — Black; marked with yellow as follows: four minute and indistinct spots on the clypeus (sometimes absent); a narrow line on the underside of the first antennal segment; a small triangular mark on the frons just above the inter-antennal shield; two narrow transverse spots on the apical margin

of the postscutellum and some very small and indistinct spots at the apex of the dorsal lateral areas of the propodeum. Articular valvulae pale yellow, partly translucent. Apical fascia of first tergite slightly wider than in *intermedius;* width of the transverse fascia of the second tergite more than half the length of the tergite, interrupted in the middle and with a rectangular incision on each side anteriorly; posteriorly the yellow markings reach the apex of the tergite at the side only, the posterior margin of the tergite thus having a black band which is almost as wide as the apical yellow fascia of the first tergite; base of second tergite with a small yellow spot on each side; the fasciae on the tergites 3 and 4 more than twice as wide as in *intermedius,* the spot on the fifth tergite somewhat larger than in that form. The sternites less extensively marked with yellow than in *intermedius:* the first sternite with narrow yellow lines along the lateral margins of its posterior half and a narrow transverse line at the apex; the basal marking on the second sternite reduced, its width being less than half the length of the sternite.

Legs black, without yellow markings; wings as in the preceding variety.

Male. — Head: clypeus with two irregular yellow lines, converging towards the apex; a small yellow spot in the eye-emargination; a short yellow line on the front between the anterior ocellus and the inter-antennal shield, the marking above the shield reduced. Thorax entirely black; articular valvulae of propodeum almost entirely translucent. The lateral yellow lines on the first abdominal sternite much reduced. Front side of tibiae I with a narrow yellow line, tibiae II and III with minute yellow spots close to the apex. The remainder as in the female.

Length (h. + th. + t. 1 + 2), ♀ 19 mm, ♂ 12½ mm.

Holotype: ♀, S.W. Java, Wijnkoopsbay, Mrs. M. E. WALSH, March 1935; allotype: ♂, E. Java, Baoeng, Dr. J. G. BETREM, Aug. 1935; paratypes: ♀, O. Java, Telawa, Dr. L. G. E. KALSHOVEN, 22 Febr. 1933; all in my collection. The Museum at Leiden possesses a male specimen which bears a label in RITSEMA's handwriting: "Dr. PLOEM, Sumatra", but I suspect that this record will prove to be erroneous and that the specimen originates from Java.

Pareumenes (Pareumenes) pullatus (SM.).

! 1863. SMITH, F., Jl. Proc. Linn. Soc. Zool. VII, p. 39, ♀ (*Eumenes pullatus*, Ceram).

The holotype (Oxf. Mus.) is a female from Ceram, it represents a species which appears to be closely allied to *P. quadrispinosus* and may perhaps be regarded as a subspecies only. It differs from the Javan form of *P. quadrispinosus* as follows:

Entirely black, except for a small spot between the antennae, and the antennal scape, which are pale yellow.

Slightly larger, puncturation somewhat coarser, especially on the frons, the temples, the mesonotum and the mesopleura. Postscutellum with some distinct punctures. Sculpture of propodeum distinctly coarser. Thorax clothed with dense, short, black pubescence. Wings more distinctly yellowish.

Pareumenes (Pareumenes) fulvipennis (CAM.).

! 1898. CAMERON, P., Mem. Manch. Soc. 42 (11), p. 39, ♀ (*Pterochilus* (sic!) *fulvipennis*, Poona).

This species must be placed in the genus *Pareumenes*, it is allied to *P. quadrispinosus* SAUSS.

Ferruginous; most of the head, pronotum and coxae I yellow; second tergite with two ill defined yellow spots, the following segments with yellow apical fasciae. Clypeus more distinctly dentate than in *P. quadrispinosus* var. *javanus* m., mesopleura less punctate than in that form. First abdominal tergite impunctate above, distinctly punctate posteriorly at the sides.

The holotype is a female from Poona, coll. ROTHNEY (Oxf. Mus.), labelled: *"Pt. flavipennis"*. The mouth parts are mounted on a slide, which bears a label: *"fulvipennis"!*

Pareumenes (Pareumenes) artifex (SM.).

! 1861. SMITH, F., Jl. Proc. Linn. Soc. Zool V, p. 86, ♀ (*Eumenes artifex*, Makassar).
1935. SOIKA, A. G., Ann. Mus. Civ. Stor. Nat. Genova LVII, p. 140, ♀ (*Pareumenes (Pareumenes) artifex*, Makassar).

The holotype, a female from Makassar, is in the Museum at Oxford. I possess a female from South Celebes, recently collected by Mr. AWIBOWO.

Pareumenes (Pareumenes) vindex (SM.).

! 1859. SMITH, F., Jl. Proc. Linn. Soc. Zool. III, p. 20, ♂ (*Eumenes vindex*, Celebes).
1882. MAINDRON, M., Ann. Soc. Ent. France (6) II, p. 269 (*Eumenes pomiformis* var. *vindex*).
1935. SOIKA, A. G., Ann. Mus. Civ. Stor. Nat. Genova, LVII, p. 142, ♂, fig. IV (*Pareumenes (Pareumenes) vindex*, Makasser).

SOIKA believes that *P. vindex* will probably prove to be the male of *P. artifex*, but until more material is available, it may be regarded as a separate species. In *P. vindex* the first and second abdominal segments are less densely punctate, the apical spines of the propodeum are shorter and the emargination of the clypeus is somewhat deeper than in *P. artifex*. *P. vindex* has the legs yellow, variegated with red and black, the legs of *P. artifex* are for the most part reddish.

Pareumenes (Pareumenes) multicolor SOIKA.

1935. SOIKA, A. G., Ann. Mus. Civ. Stor. Nat. Genova LVII, p. 138, ♀ (*Pareumenes (Pareumenes) multicolor*, Soembawa, Tambora).

Pareumenes (Pareumenes) secundus (DALLA TORRE).

! 1862. SMITH F., Jl. Proc. Linn. Soc. Zool. VI, 1862, p. 58, ♀ (*Odynerus fallax*, Gilolo; nec SAUSS. 1852).
1889. DALLA TORRE, K. W. VON, Wien. Ent. Ztg. 8, p. 125 (*Odynerus secundus*).
1894. DALLA TORRE, K. W. VON, Cat. Hym. IX, p. 95 (*Odynerus secundus*).
1904. DALLA TORRE, K. W. VON, Gen. Insect. 19, Vespidae, p. 54 (*Odynerus secundus*).

This species is allied to *Pareumenes multicolor* SOIKA; according to my notes the abdominal petiole of SMITH's type is somewhat shorter and wider.

Subgenus **Pseumenes** SOIKA.

Pareumenes (Pseumenes) depressus SAUSS. (fig. 3b).

1854. SAUSSURE, H. DE, Ét. fam. Vesp. Suppl. p. 135, ♀ (*Pareumenes depressa*, India).
1897. BINGHAM, C. T., Fauna of Br. India, Hym. I, p. 337, ♀♂ (*Eumenes depressa*, India, Tenasserim).
1929. DOVER, C., Bull. Raffles Mus. II, p. 44 (*Pareumenes depressa*, Borneo, Sarawak).
1935. PIEL, O., Notes d'Entom. Chin. II, fasc. 6 (*Pareumenes quadrispinosus*, China).

In the British Museum this species is represented by specimens from Sikkim, China, Siam, Tenasserim (Haundraw Valley) and the Malay Peninsula. Father OCTAVE PIEL, who studied the fascinating life history of this species in detail, kindly sent me a female from Zô-Se, Kiangsu, Shanghai, and this specimen appears to agree in many respects with a female from Sumatra, Res. Benkoelen, Boekit Item (650 m) and a male from Sumatra, Res. Palembang, Pagar Alam (750 m), resp. June and May 1935 (Mrs. M. E. WALSH), in my collection. Structurally, both forms are identical, but there are some differences in the coloration: in the latter specimens the lower part of the mesopleura has a large longitudinal yellow mark, which is absent in the Chinese specimen, furthermore the markings on the abdomen are smaller in the specimens from Sumatra. All specimens recorded above have two hook-shaped marks on the mesonotum.

The Javan representative of this species, which is described below, is remarkable for the reduction of the yellow markings on the head and thorax.

Pareumenes (Pseumenes) depressus SAUSS., var. **thoracicus**, new variety (fig. 3b[1]).

F e m a l e. — Black; head with more or less distinct rudiments of yellow markings at the base of the clypeus, on the frons, in the eye-emarginations and on the temples; in the darkest specimen before me (the holotype) the clypeus and the eye-emarginations are entirely black. Thorax without yellow markings, the articular valvulae of the propodeum pale yellowish, translucent. Coloration of abdomen as in the typical form: first tergite with two elongate spots behind the middle and a transverse apical fascia which is narrowly interrupted in the middle and laterally bent at right angles to be continued along the sides of the apical third or fourth of the tergite; second tergite with a large oval spot on each side at the base; second to fourth tergites with transverse apical bands, the band on the second tergite broadly emarginate anteriorly; fifth tergite with a transverse spot at the apex. Second sternite with a more or less distinct, elongate spot at the lateral margin on each side, about the middle of the sternite.

Legs black; femora I with a minute yellow spot close to the apex; front side of tibiae I with a yellow line; the claw joints of the tarsi of legs I yel-

lowish, of legs II and III brownish. Wings slightly more yellowish than in *Eumenes arcuatus* var. *blanchardi* SAUSS.

Male. — Clypeus with a large, oval, yellow spot, which is more or less deeply incised anteriorly; inter-antennal shield with a yellow spot; eye-emarginations yellow; anterior tarsi pale brownish yellow; outer side of tibiae II with an irregular yellow line. The remainder as in the female.

Length (h. + th. + t. 1 + 2), ♀ 18 - 20 mm (a female from Tjibamben measures only 13 mm), ♂ 13 - 15 mm.

Holotype: ♀, West-Java, Djampang, April 1933, native collector, leg. F. VERBEEK (coll. m.); allotype: ♂, W.-Java, Djampang Wetan, Radjamandala, Oct. 1936, Mrs. M. E. WALSH (coll. m.); paratypes: five females, W. Java: Djampang; Djampang Tengah, Tjiangsana, Mrs. WALSH; Tjibamben, F. DUPONT, all in my collection; one male (locality-label in RITSEMA's handwriting: "Dr. PLOEM, Sumatra", most probably erroneous!) in Mus. Leiden. The "female *Eumenes* from Lawang, Eastern Java, bearing a manuscript name by CAMERON" in the British Museum, mentioned by BEQUAERT (Ann. Mag. Nat. Hist. 10, II, 1928, p. 170) belongs to the here described variety of *P. depressus*.

Pareumenes (Pseumenes) depressus SAUSS., var. **pictifrons** (SM.).

! 1861. SMITH, F., Jl. Proc. Linn. Zool. V, p. 86, ♀ (*Eumenes pictifrons*, Celebes, Makassar).
1910. MEADE-WALDO, G., Ann. Mag. Nat. Hist. (8) V, p. 46 (*Pareumenes pictifrons*).
1935. SOIKA, A. G., Ann. Mus. Civ. Stor. Nat. Genova LVII, p. 147, ♀ (*Pareumenes (Pseumenes) pictifrons*).

This appears to be another colour variety of *P. depressus* SAUSS.; in structure and sculpture it agrees perfectly with my *depressus*-specimens from China, Sumatra and Java.

Black; head with yellow markings as follows: a spot at the base of the clypeus, the inter-antennal shield, the lower half of the inner orbits, the eye-emarginations, a median line on the lower part of the frons, the underside of the first antennal segment, two spots on the vertex and a short line on the temples; thorax and abdomen entirely black. Femora I and II, and all tibiae, marked with yellow, tarsi I pale brown, II and III dark brown.

The holotype is a female from Makassar (Oxf. Mus.).

Pareumenes (Pseumenes) eximius (SM.).

! 1861. SMITH, F., Jl. Proc. Linn. Soc. Zool. V, p. 126, ♀ (*Eumenes eximius*, Batjan).
1935. SOIKA, A. G., Ann. Mus. Civ. Stor. Nat. Genova LVII, p. 145, ♀, fig. V (*Pareumenes (Pseumenes) eximius*).

SOIKA has drawn attention to the close resemblance of this species to *P. depressus* var. *pictifrons*. According to this author, the only differences would appear to be found in the puncturation, which is much denser in *P. eximius*, and in the coloration. However, when I compared the types of both species, I noted that the apical teeth of the propodeum are distinct in *P. depressus* var. *pictifrons*, but almost obsolete in *P. eximius*.

Pareumenes (Pseumenes) laboriosus (SM.).

! 1861. SMITH, F., Jl. Proc. Linn. Soc. Zool. V, p. 87, ♀ (*Eumenes laboriosus*, Celebes, Makassar).

The holotype is a female from Makassar (Oxf. Mus.). From the notes which I made during an examination of the type specimen in 1934 I suspect that this species comes into the subgenus *Pseumenes,* but further investigations on its systematic position will be necessary. Body slender; the striae on the sides of the propodeum moderately sharp, the punctures between them conspicuous; the apical teeth of the propodeum are long and sharp; the posterior part of the first tergite is almost impunctate in the middle. The clypeus has a median black spot.

Pareumenes (Pseumenes) politus (SM.).

! 1861. SMITH, F., Jl. Proc. Linn. Soc. Zool. V, p. 127, ♀ (*Eumenes politus*, Batjan).

At present only the female of this species is known, but I suspect that *P. medianus,* described from Ceram, will prove to be the male of *P. politus.*

In addition to SMITH's description it may be noted that the frons and the mesonotum are densely punctate, the mesopleura have distinct punctures, and the punctures on the abdominal petiole are very fine. Postscutellum and propodeum rather coarsely punctate. The clypeus rather deeply emarginate anteriorly and with a large central black spot. With the exception of the anterior coxae the legs are entirely ferruginous.

The holotype is a female from Batjan (Oxf. Mus.).

Pareumenes (Pseumenes) medianus (SM.).

! 1863. SMITH, F., Jl. Proc. Linn. Soc. Zool. VII, p. 38, ♂ (*Eumenes medianus*, Ceram).

In "Genera Insectorum", vol. 19, p. 23 (1904) this species has erroneously been recorded by VON DALLA TORRE as *E. meridianus* SM.

According to my notes on the type (a male from Ceram in the Oxford Museum) this may perhaps be the male of *P. politus* (SM.). Clypeus entirely yellowish white, deeply emarginate as in *P. politus*. The line on the lower part of the frons narrow, abruptly widened between the antennae. As in *P. politus* the legs are ferruginous, coxae I dark. Puncturation of head and thorax less regular and slightly coarser than in *P. politus*. Abdominal petiole coarsely and irregularly punctate, more or less rugose. Mesonotum and second and following abdominal segments entirely black. Puncturation of mesopleura coarse, the punctures not well defined. Sculpture of the sides of the propodeum not exceedingly coarse.

Pareumenes (Pseumenes) sublaevis (SM.).

! 1857. SMITH, F., Cat. Hym. Br. Mus. V, p. 23, ♀ (*Eumenes sublaevis*, Borneo, Sarawak).

1928. BEQUAERT, J., Ann. Mag. Nat. Hist. (10) II, p. 171 (*Pareumenes sublaevis*).

Besides the type in the British Museum I have seen the following specimens: 1 ♀ Sumatra, MULLER, 1 ♂ N.E. Sumatra, Tandjong Morawa, Serdang, Dr. B. HAGEN, and 1 ♂ S. Borneo, all in Mus. Leiden; 1 ♂ N. Borneo, Sarawak, Kuching (SHELFORD) in Oxford Mus. (no.11321).

Pareumenes (Pseumenes) volatilis (SM.).

! 1863. SMITH, F., Jl. Proc. Linn. Soc. Zool. VII, p. 38, ♀ (*Eumenes volatilis*, Mysol).
! 1864. SMITH, F., Ibid., VIII, p. 87 (*Eumenes volatilis*, N. Guinea).
1935. SOIKA, A. G., Ann. Mus. Civ. Stor. Nat. Genova LVII, p. 148, ♀, fig. VI (*Pareumenes (Pseumenes) volatilis*).

The Leiden Museum possesses a female from Aru (ROSENBERG leg.), which differs in coloration from the holotype as follows: clypeus with only a black spot in the middle (in the type with a median black line, which is triangularly dilated in its upper half); first abdominal segment with a distinct apical yellow band, which is incised (almost interrupted) in the middle anteriorly; the spots at the base of the second tergite larger; the apical bands of the second and third tergites entire, rather wide at the sides, the median portion anteriorly with two shallow emarginations; the fourth tergite with a yellow band which is abbreviated at the sides.

Eumenes LATR.

Eumenes (Eumenes) multipictus SAUSS.

1855. SAUSSURE, H. DE, Rev. Mag. Zool. (2) 7, p. 372, ♂ (*Eumenes multipicta*, Sumatra).
1931. DOVER, C., Jl. Fed. Mal. St. Mus. 16, p. 253 (*Eumenes multipictus*, Malaya).
1935. SOIKA, A. G., Ann. Mus. Civ. Stor. Nat. Genova LVII, p. 126, ♀♂, pl. II, fig. 2 (*Eumenes acus*, Borneo, Sumatra, Java).

SOIKA's excellent description leaves no doubt that his *E. acus* is identical with *E. multipictus* SAUSS. This species is widely spread in the Malaysian subregion; it is apparently restricted to the forests.

Malaya: Pahang, 1000 ft., jungle (DOVER, l.c.); Singapore (Br. Mus.).

Sumatra: "Sumatra" (there are specimens from this island in the British Museum, but I did not see the type); Marang (SOIKA, l.c.); Serdang, Tandjong Morawa, Dr. B. HAGEN (Mus. Leiden); Lampong Distr., Soengeilangka Est., Mt. Betoeng (400 m), 27 III 1937, Mrs. VAN DER VECHT (coll. m.).

Banka Isl.: Toboali, 3 XII 1935 (I bred a ♂ from a clay cell which contained a number of small Geometrid caterpillars; the cell was affixed to a rootlet, sheltered by an overhanging bank at the side of a sunken road).

Borneo: Sarawak (SOIKA, l.c.); Sarawak, Kuching, SHELFORD (Mus. Oxf., nrs. 11181, 11195, 11196); W. Borneo, Bengkajang, Ledo (Sambas River), 25 VII 1933, H. R. A. MULLER (coll. m.); S. coast of Borneo (Mus. Leiden).

West-Java: Djasinga, 28 IV 1935, author; Djampang (Mt. Tjisoeroe and Bibidjilan), Mrs. M. E. WALSH; Djampang Wetan, Radjamandala, Mrs. M. E. WALSH (all in my collection); East-Java: Kalipare (SOIKA, l.c.).

Eumenes (Omicroides) singularis SM.

! 1858. SMITH, F., Jl. Proc. Linn. Soc. Zool. II, p. 109, ♀ (*Eumenes singularis*, Sarawak).
1882. MAINDRON, M., Ann. Soc. Ent. France (6) II, p. 268 (*Eumenes pomiformis*, var. *singularis*).
1935. SOIKA, A. G., Ann. Mus. Civ. Stor. Nat. Genova LVII, p. 129, ♀; fig. II; pl. II, fig. 1 (*Eumenes* (*Omicroides* n. subg.) *singularis*, Sarawak, Perak).

The holotype, a ♀ from Sarawak, is in the Oxford Museum. The Museum at Leiden possesses a ♀ from N.E. Sumatra, Serdang, Tandjong Morawa (Dr. B. HAGEN leg.).

Pachymenes SAUSS.

Pachymenes fragilis (SM.).

! 1857. SMITH, F., Cat. Hym. Br. Mus. V, p. 61, ♂ (*Odynerus fragilis*, Borneo).
! 1861. SMITH, F., Jl. Proc. Linn. Soc. Zool. V, p. 89, ♀ (*Odynerus petulans*, Celebes, Makassar).
! 1862. SMITH, F., Ibid. VI, p. 58 (*Odynerus maculipennis*, nec SM. 1858, Gilolo).
! 1862. SAUSSURE, H. DE, Stett. Ent. Ztg. 23, p. 195, ♀♂ (*Odynerus fragilis*, Borneo).
1897. BINGHAM, C. T., Fauna Br. India, Hym. I, p. 367 (*Odynerus fragilis*, Burma, Tenasserim, Borneo).
! 1902. CAMERON, P., Jl. Straits Br. As. Soc. 37, p. 114, (*Odynerus lybas*, Borneo, Sarawak).
! 1905. CAMERON, P., Tijdschr. v. Ent. XLVIII, p. 77, ♂♀ (*Odynerus drescheri*, Java, Tjandi near Semarang).
1908. CAMERON, P., Deutsch. Ent. Zeitschr., p. 561, ♂ (*Odynerus brooksii*, Borneo, Sarawak, Kuching).
1929. DOVER, C., Bull. Raffles Mus. 2, p. 45 (*Odynerus fragilis*, Singapore Island).
1934. SCHULTHESS, A. VON, Arb. morph. tax. Ent. Berlin-Dahlem, 1, pp. 92—94, ♀♂ (*Odynerus* (*Lionotus*) *fragilis*, Java, Formosa, Phil. Isl.).

This species has usually been regarded as an *Odynerus*, but it belongs to the genus *Pachymenes* as defined by BEQUAERT (1918); according to this authority it is exactly like the small African *Pachymenes*. A good description is given by Von SCHULTHESS (1934).

Pachymenes fragilis is a widely distributed species; in Java it is one of the commonest Vespidae and occurs everywhere in the cultivated areas from the plains up to about 1000 - 1200 m above sea-level.

As appears from the list of synonyms, *P. fragilis* has been described or recorded by SMITH and CAMERON under various names, which, after a study of the types, can no longer be regarded as valid. I did not see the type of *Odynerus brooksii* CAM., but the description leaves no doubt that it is based upon a specimen of *P. fragilis* (SM.).

It may be noted that a few specimens from Siberoet, Mentawei Isl. (Mus. Buitenzorg), have an interrupted transverse fascia at the base of the posterior part of the first tergite. A similar coloration is present in some specimens from Java in my collection, in a few others only small lateral spots are present. Also in specimens from Formosa the base and the sides of the posterior part of the first tergite are more or less marked with yellow.

Apart from these minor differences, the coloration of this species is rather constant, even in widely separated localities, and it is therefore of special interest, that M. A. LIEFTINCK discovered in 1930 a melanistic variety in the Karimon Djawa Islands, North of Java, which up to the present has not been observed elsewhere.

P. fragilis (SM.), var. **karimonensis,** new variety.

♀ - Black, with only the following pale yellow markings: a transverse line at the base of the clypeus, a spot between the antennae, a line on the underside of the first antennal segment, a small spot in the eye-emargination, a short stripe along the upper part of the outer orbits and a narrow line on the posttegulae. Tips of mandibles, tarsi, anterior tibiae and extreme apices of abdominal segments brownish. Wings more strongly infuscated than in the typical form.

♂ - Similar to the female; first abdominal segment either entirely black (allotype) or with a narrow, yellow, apical fascia.

Karimon Djawa Island, North of Java, 22 - 30 Nov. 1930, M. A. LIEFTINCK; holotype (♀) and allotype (♂) in Mus. Buitenzorg, paratypes (1 ♀, 1 ♂) in my collection.

Pachymenes icarioides (BINGH.) (fig. 4).

! 1897. BINGHAM, C. T., Fauna of Br. India, Hym. I, p. 372, ♀ (*Odynerus icarioides*, Tenasserim).

This species is closely allied to *P. fragilis* (SM.) and differs from it mainly in the sculpture, size and coloration.

♀ - Head, seen in front, slightly wider than high (39 : 36); clypeus wider than high (17 : 15), its apex slightly emarginate with dentiform angles, the distance between the angles less than ¼ of the total width of the clypeus. Mandibles with rather acute teeth. Inter-antennal shield with a median longitudinal carina. Posterior ocelli almost 1½ times as far from the eyes as from each other. Vertex with two minute tubercles behind the ocelli [1]). Thorax about the same shape as in *P. fragilis;* as in that species the postscutellum is bituberculate and consists of a short horizontal and a much longer vertical portion, and the propodeum has a well developed tooth on each side at the apex just above the articular valvula; in the present species these teeth are somewhat wider at the base than in *fragilis*. Abdomen: fig. 4; as seen from above, the second segment is about 1½ times as wide as the first (38 : 24).

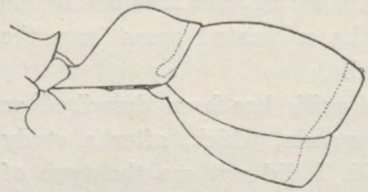


Fig. 4. — First and second abdominal segments of female of *Pachymenes icarioides* (BINGH.), lateral view.

[1]) These tubercles are also present in *P. fragilis*; apparently they have been overlooked by VON SCHULTHESS (l.c., pp. 92 - 94). The tubercles are most readily observed when the head is looked at from the front with a strong lens.

Puncturation denser and coarser than in *P. fragilis,* especially on the frons, the pro- and mesonotum, the scutellum, the mesopleura and the posterior portion of the first tergite; these parts are uniformly reticulately punctate. Puncturation of second abdominal segment slightly denser and coarser than in *fragilis.*

In coloration this species differs from *fragilis* as follows: there is no yellow spot on the frons between the antennae, the spots in the eye-incisions and on the temples are very small, the tegulae are ferruginous, the mesopleura and scutellum are entirely black, the postscutellum has a transverse yellow band, interrupted in the middle, the apical teeth of the propodeum are almost entirely yellow, the second abdominal tergite has no yellow lateral spots at the base, the third segment is black, its apical margin fuscous, the following segments entirely dark fuscous. Legs as in *P. fragilis.* Anterior margin of the fore wings slightly less infuscate than in that species.

Length (h. + th. + t. 1 + 2), 9 mm.

Described from a female from N.W. Borneo, Sarawak, Kuching, R. SHELFORD, in the Oxford University Museum (no. 1900, 11224). I compared this specimen with BINGHAM's type in the British Museum in 1934.

Pachymenes petiolatus (SM.).

! 1859. SMITH, F., Jl. Proc. Linn. Soc. Zool. III, p. 164, ♀ (*Odynerus petiolatus*, Aru).
! 1861. SMITH, F., Ibid. V, p. 129, ♂ (*Odynerus petiolatus*, Dory, N. Guinea).
1894. DALLA TORRE, K. W. VON, Cat. Hym. IX, p. 88 (*Odynerus petiolatus*).
1904. DALLA TORRE, K. W. VON, Gen. Insect. 19, Vespidae, p. 51 (*Odynerus petiolatus*).
! 1906. CAMERON, P., Nova Guinea, V, 1, p. 65, ♀ (*Eumenes spilonotus*, N. Guinea).
! 1928. BEQUAERT, J., Ann. Mag. Nat. Hist. (10), II, p. 159, ♀ (*Pachymenes spilonotus*).
1932. BEQUAERT, J., Rés. scient. voy. Ind. néerl. Leopold, vol. IV, fasc. 5, p. 50 (*Ropalidia petiolata*).

In general appearance this remarkable wasp is somewhat like *Montezumia impavida* BINGH., but structurally it is markedly different. BEQUAERT (1928) studied CAMERON's specimen from Manoekwari in the British Museum (holotype of *Eumenes spilonotus*), but was unable to examine the mouthparts and therefore would not exclude the possibility that the species belongs to the genus *Montezumia.* However, as the maxillary and labial palpi are respectively 6- and 4-jointed, it may be preliminarily placed in the genus *Pachymenes,* although it differs much from the other Oriental and Papuan representatives of that heterogeneous group.

Odynerus LATR.

The following species have been described as *Odynerus,* but belong to other genera:

Pareumenes secundus (DALLA TORRE) = ! *Odynerus fallax* SMITH (Jl. Proc. Linn. Soc. Zool. VI, 1862, p. 58, ♀, nec SAUSS. 1852) =*Odynerus secundus* DALLA TORRE, Wien. Ent. Ztg. 8, p. 125, 1889). — Type locality: Gilolo (= Halmahera).

Pachymenes petiolatus (SMITH) = ! *Odynerus petiolatus* SMITH (Jl. Proc. Linn. Soc. Zool. III, 1859, p. 64, ♀). — Type locality: Aroe. (For further synonymy see p. 279).

Ropalidia jaculator (SMITH) = ! *Odynerus fallax* SMITH (Jl. Proc. Linn. Soc. Zool. VII, 1863, p. 40, ♀; nec SAUSS. 1852, nec SMITH 1862) = *Odynerus jaculator* SMITH (Ibid., XI, 1871, p. 377) = *Odynerus tertius* DALLA TORRE (Wien. Ent. Ztg. 8, 1889, p. 125). — Type locality: Misool.

Apparently DALLA TORRE has overlooked the fact that SMITH renamed his second "*Odynerus fallax*" in 1871.

Ropalidia mysolica (DALLA TORRE) = ! *Odynerus conspicuus* SMITH (Jl. Proc. Linn. Soc. Zool. VII, 1863, p. 40, ♀; nec SAUSS. 1857) = *Odynerus mysolicus* DALLA TORRE (Wien. Ent. Ztg. 8, 1889, p. 125). — Type locality: Misool.

Ropalidia fulvopruinosa (CAM.) = ! *Odynerus* (*Leionotus*) *fulvopruinosus* CAMERON (Tijdschr. v. Ent. XLIX, 1906, p. 225). — Type locality: Etna Bay, New-Guinea.

Odynerus brunnipes (FABR.).

1804. FABRICIUS, J. G., Syst. Piez., p. 265, no. 66 (*Vespa brunnipes*, Sumatra).

1852. SAUSSURE, H. DE, Ét. fam. Vesp. I, p. 264 (unknown to DE SAUSSURE: "probablement un *Odynerus*").

1867. SAUSSURE, H. DE, Reise Novara, Zool. 2 (I), p. 12, ♀, pl. I, fig. 7 (*Odynerus javanus*, Java, Batavia).

Long ago, FABRICIUS described, under the name *Vespa brunnipes*, a wasp from Sumatra, which up to the present has not been recognized by the subsequent authors. Though the description is based upon colour characters only, it is complete enough to allow without doubt the identification of FABRICIUS' insect with *Odynerus javanus* SAUSS., a common species in Sumatra and Java. The Sumatran specimens have exactly the same coloration as those occurring in Java and therefore the name *javanus* must be sunk into synonymy. In other parts of the Archipelago this species has developed a number of colour varieties, some of which have been described by DE SAUSSURE and SMITH as different species.

The colour forms known to me may be separated as follows:

1. Legs brownish, body almost entirely black .... *O. brunnipes*, var. *atratulus*, new variety.
— Legs ferruginous .... 2.
2. Body with pale yellow markings; first abdominal tergite with a narrow yellow apical fascia .... *O. brunnipes* (F.), typical form.
— Thorax with orange-yellow markings: the first abdominal tergite black with a narrow yellow apical fascia, which is more or less reddish anteriorly .... *O. brunnipes*, var. *ignobilis* (SM.).
— Thorax with brick-red markings; posterior half of the first tergite red with a more or less distinct yellow apical fascia .... *O. brunnipes*, var. *pocillum* (SAUSS.).

The typical form of *O. brunnipes* (FABR.) is represented in my collection by specimens from various localities in Sumatra, Banka, Java and Bali.

O. brunnipes, var. **ignobilis** (SM.).

! 1861. SMITH, F., Jl. Proc. Linn. Soc. Zool. V, p. 87, ♀ (*Odynerus ignobilis*, Celebes, Makassar).

! 1862. SAUSSURE, H. DE, Stett. Ent. Ztg. 23, p. 202, ♀♂ (*Odynerus armatus*, Celebes).

Probably common in Celebes: Tondano (Mus. Leiden), Makassar (Oxf. Mus.), Paloe (a series of both sexes in my collection). Specimens from Aroe (Mus. Leiden) have the same coloration as those from Celebes.

O. brunnipes, var. **pocillum** (SAUSS.).

! 1862. SAUSSURE, H. DE, Stett. Ent. Ztg. 23, p. 204, ♂ (*Odynerus pocillum*, Timor).

In the collection of the Museum at Leiden this form is represented by specimens from Timor (including the type) and by a female from the island Wetter (SCHÄDLER leg.).

O. brunnipes, var. **atratulus,** new variety.

Structure and sculpture as in typical *O. brunnipes;* body almost entirely black, legs brownish; both sexes with a short pale yellow line in the eye-sinus; ♂: clypeus almost entirely pale yellow, first antennal segment with a pale yellow line, flagellum ferruginous beneath.

Holotype and allotype: resp. ♀ and ♂, Timor, WIENECKE (Mus. Leiden), paratypes from the same locality in Mus. Leiden and in my collection.

Odynerus maculipennis SM. (fig. 5).

! 1858. SMITH, F., Jl. Proc. Linn. Soc. Zool. II, p. 111, no. 4, ♀ (*Odynerus maculipennis*, Sarawak).

! 1905. CAMERON, P., Jl. Straits Br. As. Soc. 44, p. 161, ♀ (*Odynerus kuchingensis*, Sarawak).

♀ - Head subcircular; clypeus convex, scarcely longer than wide, somewhat flattened and strongly narrowed towards the apex, which is about one third of the total width of the clypeus, the apex emarginate and rather bluntly bidentate [1]). Vertex with two small tubercles behind the ocelli. Posterior ocelli somewhat further from the eyes than from each other. Pronotum truncate, the sides rather strongly converging towards the head. Scutellum moderately convex, with a fine median impressed line, nearly obsolete in the middle; postscutellum with a short horizontal portion and a much longer vertical face, the upper margin of the latter slightly emarginate in the middle, the postscutellum thus being bituberculate, but not distinctly bidentate. Propodeum entirely

[1]) At a superficial examination, the apical teeth seem to be rather acute, because the anterior edge of the clypeus has a brownish margin which is widened in the middle.

vertical, posterior face slightly concave, with a distinct median impressed line; the sides not carinate, with a distinct triangular tooth just above the articular valvula. First and second abdominal segments: fig. 5.

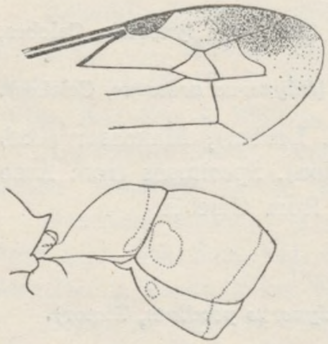


Fig. 5. — *Odynerus maculipennis* SM.; above: part of fore wing, below: lateral view of first and second abdominal segments of female.

Body slightly shining, frons dull. Clypeus finely, sparsely punctate, the punctures becoming larger towards the anterior margin; frons and vertex finely and densely punctate, more sparsely between the ocelli; mesonotum less densely punctate medially, where most of the interspaces are larger than the punctures; puncturation of mesopleura, scutellum and the lateral areas of the propodeum fine and rather sparse; anterior and posterior margins of the postscutellum crenulate. Puncturation of abdomen dense and rather fine.

Black; abundantly marked with yellow as follows: clypeus, mandibles (except for the teeth), scape of antennae (except for a dark line above), a small circular spot between the antennae, the eye-sinus, a line along the inner orbits from the sinus to the clypeus, a line behind the eyes, gradually narrowed towards the mandibles; a broad transverse band on the pronotum (not continued on the sides), tegulae (a brownish spot in the centre), posttegulae, a large spot on the upper half of the mesopleura, a broad transverse band, slightly narrowed in the middle, on the scutellum, a short transverse line, also narrowed in the middle, on the postscutellum; two large vertical marks, narrowed below, on the sides of the concavity of the propodeum; transverse apical fasciae on the 1st to 5th tergites and 2nd to 5th sternites, the line on the second segment wider than the others, that on the third tergite very narrow; two irregular lateral spots at the base of the second tergite and two similar, but smaller, spots on the sternite. Coxae I yellow in front, II and III with a yellow lateral line; trochanters dark; femora I and II yellow, with a dark line above, femora III dark, brownish at the apex; tibiae yellow, II and III with a dark line on the inner side; tarsi yellowish brown. Wings hyaline with a conspicuous cloud in the apical half of the radial cell and the anterior part of the fourth cubital cell (fig. 5), veins brownish black, stigma dark brown.

Length (h. + th. + t. 1 + 2), 7 - 8 mm.

Described from two females from N.W. Borneo, Sarawak, Kuching (R. SHELFORD) in the collection of the Oxford University Museum (1900, nrs. 11218 and 11219); I compared these specimens with the types of *O. maculipennis* SM. (Mus. Oxf.) and of *O. kuchingensis* CAM. (Br. Mus.) in 1934. Recently Mrs. M. E. WALSH collected this species in Borneo: 1 ♀, E. Borneo, Palawan besar, May 1937 and 1 ♀, S. Borneo, Tanggarang, Mt. Pandjang, 4 July 1937 (coll. m.).

F. SMITH recorded this species from Gilolo (Jl. Proc. Linn. Soc. Zool. VI, 1862, p. 58), but according to my notes WALLACE's specimen from that locality in the Oxford Museum is a male of *Pachymenes fragilis* (SM.).

Odynerus latipennis SM.

! 1858. SMITH, F., Jl. Proc. Linn. Soc. Zool. II, p. 112, ♀ (*Odynerus latipennis*, Borneo, Sarawak).

During my visit to the Oxford Museum I made the following notes on the holotype:

Anterior margin of clypeus narrowly truncate. First segment somewhat narrower than the second. Abdomen very finely punctate, the apical margins of the first and second tergites distinctly depressed and shining. Scutellum flat, postscutellum entirely included in the dorsal face of the thorax, the posterior face formed by the obliquely sloping propodeum only. The vertical base of the first abdominal tergite yellow. This species superficially resembles *O. rugifrons* CAM., but differs from it by the shape of the clypeus (anterior margin slightly emarginate in *O. rugifrons*), the coloration of the mesopleura (black with yellow spots in the present species; entirely yellow in *O. rugifrons*) and the absence of yellow spots on the second abdominal tergite.

Odynerus cilicius CAM.

! 1902. CAMERON, P., Jl. Straits Br. As. Soc. 37, p. 111, ♀ (*Odynerus cilicius*, Borneo, Sarawak, Kuching).
1910. MEADE-WALDO, G., Ann. Mag. Nat. Hist. (8) 6, (p. 100?).

According to MEADE-WALDO, this species is identical with *O. latipennis* SM., but having seen the types of both species, I do not believe that his view is correct. *O. cilicius* has the head and the thorax rather sparsely and superficially punctate, whereas these parts are more strongly punctate in *O. latipennis*.

The propodeum is rounded at the sides, the anterior half of the first abdominal tergite is yellow, the second tergite has two transverse yellow bands which are anastomosing at the sides. Puncturation of the abdomen very fine and superficial.

The holotype is a female from Sarawak, Kuching (Br. Mus.).

Odynerus hewittii CAM.

! 1907. CAMERON, P., Ann. Mag. Nat. Hist. (7) 20, p. 82, ♂ (*Odynerus hewittii*, Sarawak, Kuching).

First abdominal segment truncate anteriorly, but without a transverse ridge or carina; coloration almost exactly the same as in *Ancistrocerus bilaminatus* V. D. VECHT (p. 292), with which species it agrees moreover in many structural characters; the puncturation is, however, finer and sparser than in that species and the depressed and translucent posterior margins of the abdominal segments are extremely narrow.

♂ - Head slightly wider than high, widest above the middle; clypeus somewhat wider than long, strongly narrowed towards the truncate apex, which

is slightly broader than ¼ of its greatest width. Inter-antennal shield with a strong longitudinal carina; frons almost flat. Posterior ocelli 1½ times as far from each other as from the eyes, and about as far from each other as from the occiput. Third antennal segment nearly 1½ times as long as the fourth, ultimate segment small and recurved, its end reaching the apex of the tenth segment.

Pronotum truncate, the horizontal part much narrowed in the middle, where the posterior flattened margin is contiguous with the transverse carina over a distance greater than the space between the ocelli, the sides rather strongly converging towards the head. Mesonotum slightly wider than long; scutellum and postscutellum flat, the latter entirely included in the horizontal face of the thorax. Horizontal area of the propodeum well developed laterally (its sides parallel at the base, converging posteriorly), almost linear and strongly impressed in the middle, the posterior face concave, with a strong, median, impressed line, entirely margined by a fine carina, the sides below angular as in *Ancistrocerus bilaminatus*.

First abdominal segment truncate anteriorly, higher than long, the posterior portion distinctly wider in the middle than at the sides. Second segment, seen from above, less than 1¼ times as wide as the first. The depressed and translucent posterior margins of all the segments very narrow, and not flared, much narrower than in *Ancistrocerus septemfasciatus* and allied species.

Puncturation finer and sparser than in *Ancistrocerus bilaminatus*, similar to that of *Odynerus guttulatus* SAUSS.; the interspaces on the frons and mesonotum distinct, flat and quite dull; vertex more sparsely punctate, the two longitudinal yellow lines on the mesonotum slightly raised and almost impunctate; mesopleura densely punctate, metapleura impunctate and shining; the dorsal lateral areas of the propodeum impunctate at the base, posteriorly with a row of large and deep punctures along the carina bordering the concavity, the latter impunctate and shining; the ventral lateral areas with irregular punctures and striae, most coarsely sculptured in their upper part. First and second abdominal segments with a few indistinct punctures at the sides, the remainder of the abdomen impunctate.

Black; abundantly marked with yellow as follows: clypeus, mandibles (except for their margins), underside of first antennal segment, ocular sinus, a line from the sinus to the clypeus, a longitudinal mark (narrowed above and widened below) on the frons between the anterior ocellus and the antennal shield, a triangular spot on each side of the vertex (situated behind the ocelli and almost touching the eyes), a line on the temples, a broad transverse line (widened at the sides) on the pronotum, two lines on the mesonotum, two large spots on the mesopleura, tegulae (except for a brownish spot in the centre), posttegulae, a transverse band on the anterior ⅔ of the scutellum (emarginate posteriorly), a transverse line on the postscutellum; a large mark on the propodeum, interrupted in the middle and covering the dorsal lateral areas, the upper and posterior margins of the ventral lateral areas, and the upper and

lateral margins of the concavity; a transverse band at the base of the posterior portion of the first abdominal tergite, a band near the base of the second tergite, and similar bands on the posterior margins of the 1st to 6th tergites. The two bands on the first and the second tergites are connected laterally by a short longitudinal line; the basal band of the second tergite is rather strongly dilated at the sides; the apical bands of the five anterior tergites are narrowly incised in the middle; the seventh tergite has an indistinct yellow spot in the middle near the apex. The second sternite is yellow, with a large, quadrate, black spot at the base; the third to sixth sternites have yellow apical fasciae. Legs yellow; posterior face of coxae II and III, trochanters, and lines on all femora and tibiae brownish black; apical tarsal segments ferruginous.

Wings subhyaline, iridescent, darker along the anterior margin, with an ill defined and not very dark cloud in the apical two thirds of the radial cell and the upper margin of the fourth cubital cell.

Length (h. + th. + t. 1 + 2), ♂: 9 mm.

Described from two males from Borneo, Sarawak, Kuching (SHELFORD leg.) in the Oxford Museum (nrs. 1900: 11199 and 11216); in 1934 I compared these specimens with the holotype of *Odynerus hewittii* CAM. (which is from the same locality) in the British Museum.

CAMERON's remarkable conceptions of the structure of his objects of "study" are well demonstrated by the following quotation from his description of the coloration of the abdomen: "......the first abdominal segment at the top of the apical slope, its apex and the apices of the following seven (sic!) segments, dilated laterally and that on the seventh also in the middle, a mark in the centre of the eighth...... yellow".

Odynerus guttulatus SAUSS.

! 1862. SAUSSURE, H. DE, Stett. Ent. Zeitg. 23, p. 200, ♀(*Odynerus guttulatus*, Sumatra).
1891. GRIBODO, G., Bull. Soc. ent. Ital. XXIII, p. 297, ♀ (*Odynerus guttulatus*).
? 1897. BINGHAM, C. T., Fauna Br. India, Hym. I, p. 368, ♀ (*Odynerus multipictus*, India, Borneo) (nec *multipictus* SM.?).
! 1908. CAMERON. P., Deutsch. Ent. Zeitschr., p. 562, ♀ (*Odynerus santubongensis*, Borneo: Santubong).

The holotype of *O. guttulatus* SAUSS., a female from Sumatra (MULLER leg.), is in the Leiden Museum. H. DE SAUSSURE believed this species to be conspecific with *O. multipictus* SM. (1858, nec SM. 1859) from Borneo, but it is undoubtedly different, as has been noted by GRIBODO (1891).

Whether the specimens recorded by BINGHAM (1897), VON SCHULTHESS (1914) and DOVER (1929) as *O. multipictus* SM. were correctly identified, remains doubtful; I suspect that at least some of them will prove to belong to *O. guttulatus* SAUSS.

The holotype of *guttulatus* has two yellow lines on the mesonotum, the clypeus is yellow with an irregular black spot in the middle, the yellow mark on the scutellum is excavated posteriorly, the postscutellum bears a narrow

transverse yellow fascia, the mesopleura have two yellow spots, and the first abdominal segment has two transverse yellow fasciae, the first of which is widely interrupted in the middle and abbreviated at the sides. I was not able to find any differences of importance between typical *guttulatus* and the holotype of *O. santubongensis* CAM., which I examined in the British Museum.

Besides the specimens mentioned above I studied 4 ♀♀ and 3 ♂♂ from S. Sumatra, Lampong Districts (Kasoei, Kedaton, Oosthaven, Soengeilangka), 1 ♂ from W. Borneo, Bengkajang (Ledo at the Sambas-river, Dr. H. R. A. MULLER leg.) (all in my collection), and 2 ♀♀ and 1 ♂ from N. Borneo, Sarawak (Kuching, SHELFORD leg.) in the Oxford Museum (nrs. 11204, 11213 and 11212).

The yellow lines on the mesonotum are very small in some specimens, the postscutellum is usually black, and in the male sex the spot on the clypeus is sometimes entirely absent.

The following two forms have been described as separate species, but as I am unable to find any characters in structure or sculpture, by which they differ from *O. guttulatus,* I prefer to regard them as colour varieties of that species.

O. guttulatus, var. **heterospilus** (CAM.).

! 1907. **CAMERON, P., Ann. Mag. Nat. Hist. (7) 20, p. 85, ♀ (*Ancistrocerus megaspilus*, Sarawak, Kuching).**

! 1914. **MEADE-WALDO, G., Ann. Mag. Nat. Hist. (8) 14, p. 405 (*Odynerus megaspilus*).**

1931. **DOVER, C., Jl. Fed. Mal. St. Mus. 16, p. 255 (*Odynerus megaspilus*, Selangor, Peninsular Siam).**

It is doubtful whether this form will prove to be constantly different from typical *guttulatus*. The clypeus is entirely yellow, the posterior margin of the transverse yellow band on the scutellum is almost straight. — Mesonotum with two yellow lines as in the typical form.

I studied 2 ♀♀ and 1 ♂ from the type locality (Borneo, Sarawak, Kuching, SHELFORD leg.; Oxford Mus., nrs. 11209, 11215 and 11217), which I had compared with the holotype of *O. megaspilus* in the British Museum in 1934. In my collection are 1 ♀ and 3 ♂♂ from S. Sumatra (Benkoelen and Lampong Districts) and 1 ♂ from Banka Island.

O. guttulatus, var. **megaspilus** (CAM.).

! 1907. **CAMERON, P., Ann. Mag. Nat. Hist. (7) 20, p. 84, ♀ (*Odynerus heterospilus*, Sarawak, Kuching).**

The holotype of this species, a female from Borneo, is in the British Museum. It bears a label in CAMERON's handwriting: "*Odynerus erythrospilus* type", but as far as I know, CAMERON never described an *Odynerus* from Borneo under that name. As the specimen mentioned agrees perfectly with the description of *O. heterospilus,* I cannot doubt that it is correctly regarded as the type of that species. Similar errors are frequently met with in CAMERON's work.

The present variety differs from typical *guttulatus* as follows:

♀ - Clypeus entirely yellow; mandibles yellow, their margins brownish; the spot above the inter-antennal shield about half as long as in *guttulatus;* the vertex, the posterior angles of the pronotum and two spots on the mesonotum dull reddish; the extent of the latter markings is apparently variable. Anterior and posterior margins of the tegulae yellow; the transverse band on the scutellum narrow, the postscutellum black. First abdominal segment orange-red, marked with yellow as in *guttulatus,* but the transverse spots at the base of the posterior portion sometimes indistinct. Second tergite without lateral yellow spots; second sternite black with a narrow, yellow, apical fascia, the base and the sides sometimes more or less yellowish; the third to fifth segments with narrow, pale brownish, apical fasciae, the sixth segment yellow, brownish at the base. Legs: anterior face of coxae I yellow, coxae II and III with a lateral yellow line, trochanters brownish, femora I and II and all tibiae yellow, each with a longitudinal brownish line, femora III brown, tarsi yellow.

Described from 2 ♀♀ from Borneo, Sarawak, Kuching (SHELFORD leg.) in the Oxford Museum (nrs. 11244 and 11245). In 1934 I compared these specimens with CAMERON's type in the British Museum.

O. guttulatus, var. **nigridorsus,** new variety.

This is the Javan representative of *O. guttulatus.* It appears to be so constantly different from the typical form, that it deserves to be regarded as a variety. It differs from the typical form in having the clypeus entirely yellow, whereas the yellow lines on the mesonotum are always absent. Postscutellum always black. The transverse yellow lines at the base of the posterior portion of the first tergite are often more or less reduced.

Holotype: ♀, W. Java, Djasinga (100 m), 15 XI 1936; allotype: ♂, from the same locality, 28 IV 1935 (author); paratypes from several localities in W. Java (Depok, Buitenzorg, Tjiampea, Tapos on Mount Gedeh, Soekaboemi, Djampang, Wijnkoopsbay) and from Baoeng and Poerwodadi in E. Java; all in my collection. This species occurs in light forests up to about 800 m above sea-level.

Odynerus boholensis v. SCHULTH.

1934. SCHULTHESS, A. VON, Arb. morph. tax. Ent. Berlin-Dahlem I, no. 2, pp. 91 - 92, ♀♂ (*Odynerus* (*Lionotus*) *boholensis,* Philippine Islands).

Dr. A. VON SCHULTHESS kindly sent me a paratype (♂ from Bohol) of this species, which appears to be very closely allied to *O. guttulatus.* It differs from the latter as follows: anterior margin of clypeus with a deep triangular incision; puncturation of head and thorax sparser, the interspaces shining; dorsal lateral areas of propodeum with distinct punctures, ventral lateral areas almost impunctate and shining. Depressed apical margin of second abdominal tergite extremely narrow.

Odynerus duplostrigatus v. SCHULTH.

1934. SCHULTHESS, A. VON, Arb. morph. tax. Ent. Berlin-Dahlem I, no. 2, pp. 95 - 96, ♀♂ (*Odynerus* (*Lionotus*) *duplostrigatus*, Philippine Islands).

A female from Sarawak, Kuching (SHELFORD) in the Oxford Museum (no. 11214) may safely be regarded as belonging to this species. The clypeus has a short longitudinal black line in the middle, the inner orbits above the sinus are black, there is a yellow spot on each side between the ocellus and the eye; the scutellum has two yellow spots, and the lateral and posterior margins of the second abdominal sternite are yellow. Otherwise agreeing with the original description.

Odynerus multipictus SM.

! 1858. SMITH, F., Jl. Proc. Linn. Soc. Zool. II, p. 112, ♀ (*Odynerus multipictus*, Borneo, Sarawak) (nec *O. multipictus* SM. 1859).

In coloration very similar to *O. guttulatus* SAUSS. The following differences may be noted: yellow lines on mesonotum longer and wider; the yellow spot on the lower part of the mesopleura larger; the basal band of the first abdominal segment well developed, much longer than the posterior band which is abbreviated at the sides.

O. multipictus may easily be distinguished from *O. guttulatus* by the much coarser sculpture, the frons, vertex, pro- and mesonotum and mesopleura being coarsely reticulately punctate, without any flat interspaces. The yellow lines on the mesonotum are somewhat raised and almost impunctate. Concavity of propodeum bordered by a strong carina, incised and more or less distinctly bidentate in its upper part. First abdominal tergite with a very faint transverse ridge, this species thus being more or less intermediate between *Odynerus* and *Ancistrocerus*. The posterior margin of the abdominal tergites not depressed; the anterior three tergites distinctly, but sparsely and rather finely, punctate.

In the male the clypeus is yellow, with a brownish spot of variable size at the apex, the latter very slightly emarginate; the last antennal segment slender and recurved, almost reaching the middle of the tenth segment.

I studied a female from Borneo, Sarawak, Kuching (Oxf. Mus., no. 1900, 11198) which I compared with SMITH's type in the same Museum in 1934. In the Museum at Buitenzorg is a ♀ from W. Sumatra, Padang, Nov. 1924 (C. BODEN KLOSS and N. SMEDLEY). In Java this species is rare and apparently restricted to the primary forests. W. Java: 1 ♀, Djampang, F. A. TH. H. VERBEEK, 1 ♀, Radjamandala (400 m), 1 ♀ 1 ♂, E. Priangan, Penandjoeng; E. Java: 1 ♀ 1 ♂, Tengger (1000 m), 1 ♂, Waterfall Baoeng (400 m), Mrs. M. E. WALSH (coll. m.). The last specimen may be regarded as the allotype.

It is uncertain whether the specimens recorded as *O. multipictus* SM. by BINGHAM (Fauna Br. India, Hym. I, 1897, p. 368), VON SCHULTHESS (Zool. Jahrb. Syst. 37, 1914, p. 266) and DOVER (Bull. Raffles Mus. 2, 1929, p. 45) really belong to this species; I suspect that these authors did not distinguish *O. multipictus* SM. from *O. guttulatus* SAUSS.

In the specimens from Java the yellow markings are slightly less extensive than in those from Borneo and Sumatra.

Odynerus obscurus (Sm.).

! 1858. Smith, F., Jl. Proc. Linn. Soc. Zool. II, p. 110, ♀ (*Rhynchium obscurum*, Borneo, Sarawak).

As far as I know, this species has not been recorded since it was described by Smith in 1858. I studied a ♂ from Borneo, Sarawak, Kuching in the collection of the Oxford Museum, which I compared with the type in 1934, and a ♀ from Sumatra, Benkoelen, Tandjong Sakti, May 1935 (Mrs. M. E. Walsh) in my collection.

O. obscurus is closely allied to the common *O. argentatus* (F.), but in both sexes it is easily separated from that species by the following characters:

Body stouter; head slightly flatter; clypeus truncate anteriorly (not emarginate as in *O. argentatus*); propodeum shorter and wider, somewhat less rounded at the sides; wings brownish beyond the cells, with a very dark and conspicuous cloud covering the radial cell, the upper part of the third and the larger part of the fourth cubital cell; there is a hyaline line along the outer margin of the lower half of the third cubital cell; tegulae and narrow lines along the apical margins of the abdominal tergites (sometimes indistinctly) brownish red; body covered with a brownish yellow tomentum (silvery in *argentatus*). As in *O. argentatus* the ♂ has a flattened tubercle on the seventh sternite.

The ♂ in the Oxford Museum is herewith designated as the allotype.

Odynerus iridipennis (Sm.).

! 1861. Smith, F., Jl. Proc. Linn. Soc. Zool. V, p. 128, ♀ (*Rhynchium iridipenne*, Amboina).

An examination of the holotype in the Oxford Museum showed that this species is closely allied to *O. argentatus* (F.). Body more slender; clypeus very slightly longer than wide between the eyes (30 : 29), anterior margin as deeply emarginate as in *O. argentatus;* puncturation of the thorax coarser than in that species; first and second abdominal segments more distinctly punctate; the sides of the first segment less distinctly converging towards the base; as seen from above this segment appears to be transversely truncate at the base, not rounded as in *O. argentatus.*

The specimens recorded by von Schulthess (Zool. Jahrb. Syst. 37, 1914, p. 263) as *Rhynchium iridipenne* will probably prove to belong to another species.

Odynerus flavolineatus (Sm.).

! 1857. Smith, F., Cat. Hym. Br. Mus. V, p. 60, ♀ (*Odynerus flavolineatus*, Java).
! 1862. Saussure, H. de, Stett. Ent. Zeitg. 23, p. 197, ♀♂ (*Odynerus flavolineatus*, Java).
1897. Bingham, C. T., Fauna Br. India, Hym. I, p. 360, ♀ (*Rhynchium flavolineatum*, Sikhim, Tenasserim, Java).
1931. Dover, C., Jl. Fed. Mal. St. Mus. 16, p. 255 (*Odynerus* (*Rh.*) *flavolineatus*, Pahang, Perak).

This species appears to be widely distributed in the Western part of the Archipelago; in Java it is not common and apparently restricted to the primary forests.

I have seen the following specimens: 2 ♀♀, 1 ♂, W. Borneo, Bengkajang, Ledo, Dr. H. R. A. MULLER (coll. m.); Sumatra: 1 ♀, Soengei Simawoeng, Sum.-exp. 1877 (Mus. Leiden), 2 ♀♀, Benkoelen, Tandjong Sakti, Mrs. M. E. WALSH, 1 ♂, Lampong Districts, Kedaton, Wai Rilau, Mrs. VAN DER VECHT; W. Java: 2 ♀♀, Djampang, Mrs. M. E. WALSH (coll. m.), 1 ♀, Penandjoeng Bay, Kali-poetjang, M. A. LIEFTINCK (Mus. Buitenzorg); M. Java: 1 ♀, Salatiga, 1910 (coll. Prof. W. ROEPKE); E. Java: 3 ♀♀, 4 ♂♂, Waterfall Baoeng, Dr. J. G. BETREM (coll. m., additional specimens in coll. BETREM); 1 ♀, Bajoekidoel, H. LUCHT (coll. m.).

Odynerus xanthozonatus ASHM.

! 1903. CAMERON, P., Jl. Straits Br. As. Soc. 39, p. 168, "♂" (♀ !) (*Odynerus carinicollis, xanthozonatus*, Phil. Islands).

1928. WILLIAMS, F. X., Phil. Jl. Science 35, p. 99, ♂, pl. 6, figs. 1 and 3 (*Odynerus (Leionotus) xanthozonatus*, Phil. Islands).

1934. SCHULTHESS, A. VON, Arb. morph. tax. Ent. Berlin-Dahlem, Bd. 1, pp. 96 - 97, ♀♂ (*Odynerus (Lionotus) chartergoides*, Phil. Islands).

Two specimens from Los Baños, determined and kindly sent to me by WILLIAMS, agree in all respects with the description of *O. chartergoides*. As the determination is in my opinion correct, I regard the latter name as a synonym of *xanthozonatus*.

The Philippine species is closely allied to *O. manifestus* SM. from Borneo; they can be placed together with *tinctipennis* WALK. (1860), *wroughtoni* CAM. (1898) and *laboriosus* SM. (1863) (= *waigeuensis* CAM. 1913) in a well defined group which may be indicated as the *manifestus*-group.

Ancistrocerus WESMAEL.

Ancistrocerus carinicollis (CAM.).

! 1903. CAMERON, P., Jl. Straits Br. As. Soc. 39, p. 168, "♂" (♀ !) (*Odynerus carinicollis*, Sarawak, Kuching).

♀ - Head subcircular, rather thick; clypeus slightly wider than long, almost flat, narrowed towards the apex which is slightly emarginate with dentiform angles and measures about one third of the total width of the clypeus. Antennae short and thick, third segment shorter than wide at the apex, fourth segment as long as the third, $1\frac{1}{3}$ times as wide as long, the following segments even slightly wider, the last segment broadly rounded at the end. Inter-antennal shield with a distinct median carina. Frons regularly convex; posterior ocelli

a trifle further from the eyes than from each other. Temples narrow, separated from the occiput by a strong carina.

Thorax rather long and narrow, rectangular. Pronotum truncate, with a well marked transverse carina, the sides parallel posteriorly, slightly converging towards the head anteriorly. Mesonotum, scutellum and postscutellum very slightly convex, the latter entirely included in the dorsal face of the thorax. Propodeum truncate posteriorly, the horizontal area rather wide at the sides, much narrowed towards the middle, where it is depressed and narrowly incised, the apex of the postscutellum almost touching the concavity, which is moderately impressed with carinate margins.

The anterior face of the first abdominal segment fits perfectly into the concavity of the propodeum; the tergite has a long vertical and a somewhat shorter horizontal portion, these parts are separated by an indistinct, partly interrupted, transverse ridge; second abdominal segment slightly wider than the first, much wider than long; its sternite with a curved, crenulate, transverse groove at the base.

Head and thorax dull, abdomen moderately shining. Clypeus irregularly and rather sparsely punctate, puncturation of frons, pronotum, mesopleura, scutellum, postscutellum and horizontal area of propodeum deep, coarse and reticulate, slightly less dense on vertex and mesonotum; the anterior portion of the first abdominal segment impunctate, the posterior part distinctly, irregularly punctate at the base (more coarsely on the sides), apical half almost impunctate. Second segment finely and sparsely punctate, the puncturation of the third segment very fine, the following segments almost impunctate.

Black; pronotum red; the following parts pale yellow: the clypeus partly, the eye-sinus, a line on the under side of the antennal scape, a subcircular spot above the inter-antennal shield, a line on the upper part of the temples, a small spot on the mesopleura below the tegulae, the posttegulae, a broad line along the upper and lateral margins of the concavity of the propodeum, slightly interrupted in the middle above, and narrow bands on the apical margins of the first five tergites and of the second sternite. On the third sternite an apical band is indicated by a few spots; the band on the fifth tergite, and perhaps also on some of the others, may be obsolete; the band on the second tergite is wider than the others and shows a minute incision in the middle anteriorly. Mandibles pale ferruginous, tegulae ferruginous-yellow, prosternum and coxae I dark ferruginous; coxae II and III, trochanters and femora II and III brownish; femora I brownish yellow; tibiae I and II ferruginous with a pale yellow line on the outer side, tibiae III brownish, pale yellow at the base; tarsi ferruginous, the basal segments pale yellow. Wings hyaline, with a faint cloud in the apical half of the radial cell and the upper part of the fourth cubital cell.

The coloration of the clypeus appears to be variable: in the type it is yellow, with a black transverse mark in the middle, whereas in the specimen

before me there is only a transverse yellow line, slightly interrupted in the middle, at the base.

Length (h. + th. + t. 1 + 2), 7 mm.

Described from a female from N.W. Borneo, Sarawak, Kuching, 1899 (R. SHELFORD) in the collection of the Oxford University Museum (no. 1900, 11207). I compared this specimen with CAMERON's type (Br. Mus.) in 1934.

Recently Mrs. M. E. WALSH collected a female of this species in S. Borneo (Loa Teboek, 3 July 1937), which differs from the specimen described above as follows: scutellum and postscutellum reddish, apical fascia of first tergite partly obsolete, third and fourth tergite with small lateral spots, fifth tergite black.

Ancistrocerus bilaminatus, new species.

This species may easily be confused with *Odynerus multipictus* SM., with which it agrees in size and coloration. However, the first tergite bears a distinct transverse carina, whereas *O. multipictus* has only a faint indication of such a structure. The median incision of the horizontal area of the propodeum is wider, the lower part of the concavity is abruptly narrowed towards the abdomen, the sides thus being angular below. The apical margins of the second and third abdominal segments are depressed, and produced into short, thin, somewhat flaring, margins.

The two yellow fasciae on the first tergite are connected at the sides by a short lateral, longitudinal, line; the second abdominal segment has a median and a posterior transverse fascia (in *O. multipictus* there are two lateral spots and a posterior fascia).

A. bilaminatus appears to resemble *Odynerus laminiger* GRIBODO (Bull. Soc. Ent. Ital. 23, 1891, p. 299), which was described from Liangtéan in Borneo, but according to the description of that species the apical margins of all abdominal segments are depressed and testaceous.

Malaya: 1 ♂, Selangor, Bukit Kutu (3500′), H. M. PENDLEBURY; 1 ♀, Siberoet Island, W. of Sumatra, Sept. 1924, C. BODEN KLOSS and N. SMEDLEY (Mus. Buitenzorg); 1 ♀, S. Sumatra, Ranau, 24 Aug. 1933, Dr. H. R. A. MULLER (holotype, coll. m.); 1 ♂, Borneo, Sarawak, Kuching, SHELFORD (Oxf. Mus., no. 1900, 11203); 3 ♂♂, W. Java, Djampang Tengah, Mt. Tjisoeroe, Mrs. M. E. WALSH (one of these is the allotype, coll. m.).

In the specimens from Java the anterior fascia of the second tergite is slightly interrupted in the middle.

The Museum at Leiden possesses an *Ancistrocerus*-specimen from Sumatra (MULLER leg.) which probably represents a closely allied, hitherto undescribed, species. The sides of the propodeal concavity are not angular below and also the fourth abdominal segment has a distinctly depressed apical margin. As the specimen is unique and not in good condition, I prefer to leave this form unnamed until more material is available.

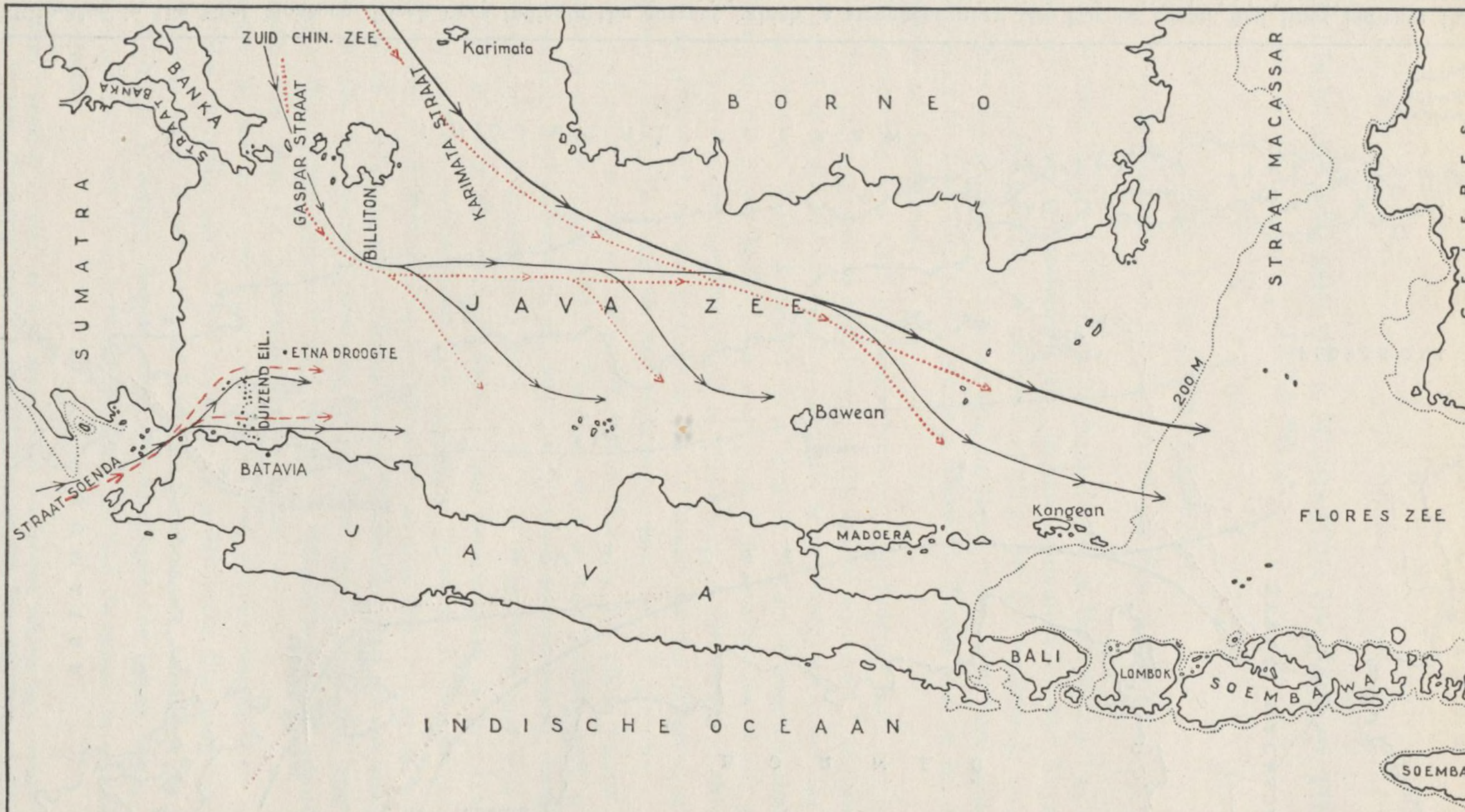
Gribodia ZAVATTARI.

Gribodia confluenta (SM.).

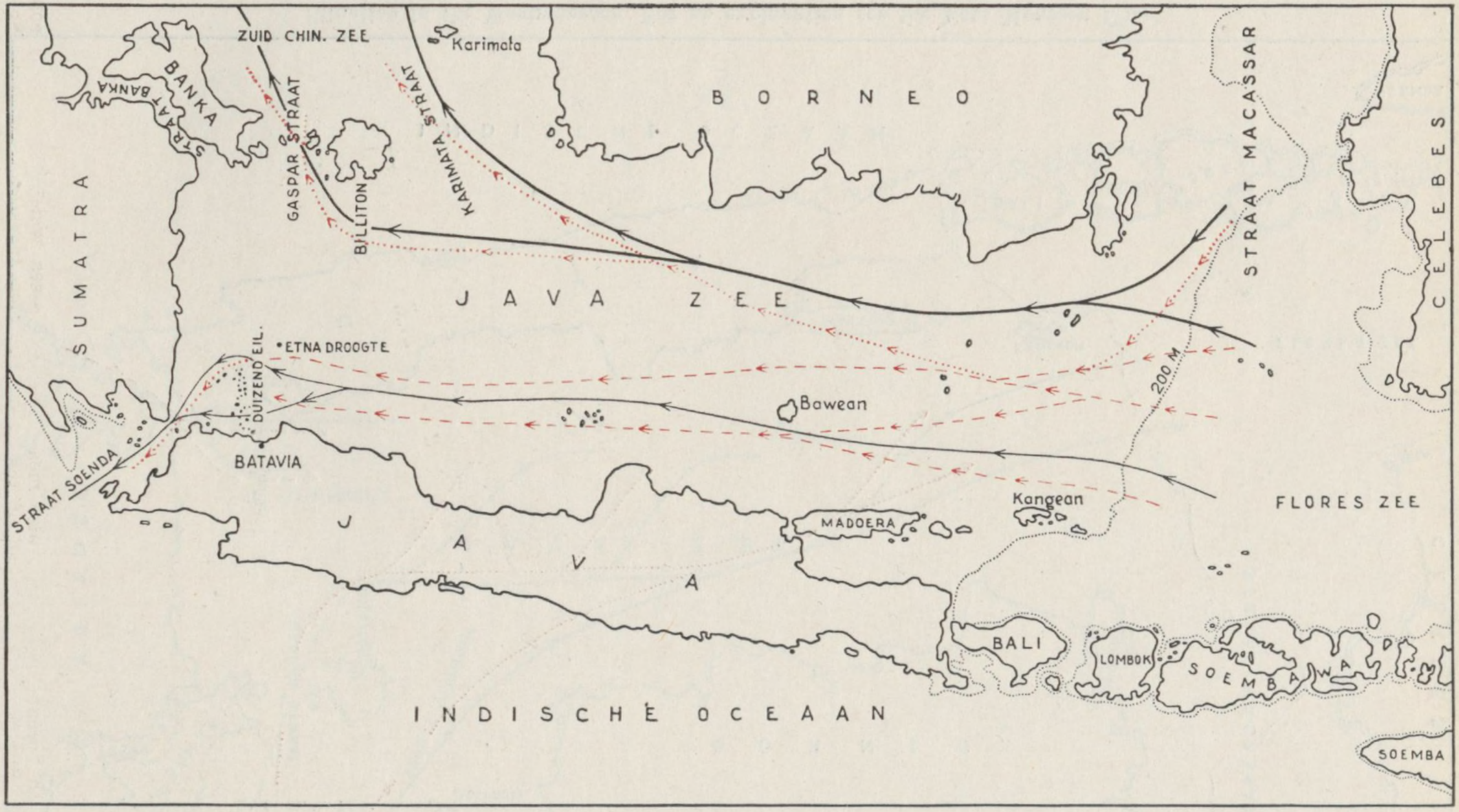
! 1857. SMITH, F., Cat. Hym. Br. Mus. V, p. 62, ♀ (*Odynerus confluentus*, Sumatra).
1891. GRIBODO, G., Bull. Soc. ent. Ital. 23, p. 267, ♀♂ (*Monobia cavifrons*, Pulo Laut).
! 1897. BINGHAM, C. T., Fauna Br. India, Hym. I, p. 367, ♀ (*Odynerus confluentus*, Tenasserim, Sumatra).
! 1902. CAMERON, P., Jl. Straits Br. As. Soc. 37, p. 112, ♀ (*Odynerus hyades*, Borneo, Sarawak).
1903. CAMERON, P., Ibid. 39, p. 168 (*Odynerus hyades*).
1910. MEADE-WALDO, G., Ann. Mag. Nat. Hist. (8) VI, p. 100 (*Odynerus confluentus* = *hyades*).
1912. ZAVATTARI, E., Arch. f. Naturgesch. 78A, H. 4, p. 162, ♀♂ (*Gribodia cavifrons*, Malaya, Borneo, Pulo Laut).
1929. DOVER, C., Bull. Raffles Mus. 2, p. 45 (*Odynerus confluentus*, Borneo, Sarawak).
1931. DOVER, C., Jl. Fed. Mal. St. Mus. 16, p. 255 (*Odynerus confluentus*, Malaya).

As has been stated by CAMERON (1903), this species is variable as regards the amount of yellow on the body and the legs.

In the British Museum I examined the types of SMITH and CAMERON, and two specimens from the BINGHAM collection: a female from Tenasserim, Thaungyin Valley, agreeing with SMITH's type, and a very large and dark female from Assam, Margherita. The latter specimen has a black spot on the clypeus, the markings on the sides of the thorax much reduced, the scutellum black, and only the first and second abdominal segments with yellow apical fasciae. — Further specimens examined: 1 ♂, E. Borneo, Pelawan Besar, Mrs. M. E. WALSH (coll. m.); 1 ♀, Sumatra, Serdang, Tandjong Morawa, Dr. B. HAGEN (Mus. Leiden); 1 ♂, Mentawei Isl., Sipora, Dr. H. H. KARNY (Mus. Buitenzorg; in this specimen the yellow markings are very extensive); 6 ♀♀, W. Java, Djampang, Mts. Tjimerang and Tjisoeroe, F. A. TH. H. VERBEEK and Mrs. M. E. WALSH (coll. m.) and 1 ♂, W. Java, Radjamandala (400 m), Mrs. M. E. WALSH (coll. m.).



Situation in the Westmonsoon. For an explanation see the East Monsoon Chart.



Situation in the East Monsoon. Black lines indicate the current, which is strongest near the Borneo coast. Red lines indicate the movement of the lajang; the dotted ones show a movement which is more or less hypothecal thus far, the dashed show the movement which is more or less certain.

PRELIMINARY REPORT ON A MIGRATION OF FISH IN THE JAVA SEA

by

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One of most important fisheries in the Java-sea is that on the lajang, a *Decapterus*-species (*Carangidae*), the Indian equivalent of the European horse-mackerel. What is called lajang by the natives is not one single species but a mixture of some two or three, which are very alike. In the wellknown book on the Indo-Australian fishes by WEBER and DE BEAUFORT four species are mentioned.

The occurrence of a fifth is certain however and judging from the distribution of two more species as mentioned in the rather scattered literature the occurrence of a sixth and even of a seventh is probable, provided that all statements are true, which I doubt! As a matter of fact I suppose that the systematics of the genus badly need a revision. The systematics of the genus *Decapterus* however are not the object of this paper. A discussion of this will have to be postponed. As the biology so far as known of the different species is in general about the same we will treat them here as a single one.

The lajang seems to be a fish which lives in the clear waters of a high salinity of the ocean and of the deep seas in the eastern part of the Indo-Australian Archipelago. In the shallow Java-sea mostly young, immature specimens are found though they may grow here to maturity and may even spawn. The latter is the case at least in the eastern part of the Java-sea bordering upon the deep Flores-sea with its oceanic water. I am not sure however that all species reach maturity in the Java-sea, at any rate not in its western part, which is fundamentally different from the eastern half as we shall see later on. Really full grown specimens, which may attain twice the length of beginning maturity are seldom if ever caught in the Java-sea. All records at my disposal are from the bordering deeper water.

In general we may say that lajang is not caught nearer than about twenty miles from the coast. The lajang is a fish from the open sea with pelagic habits, which is not really at home in the Java-sea, though some parts may suit him to a certain degree when the circumstances (clear water of a sufficient salinity) are favourable. Lajang in the Java-sea is of oceanic origin therefore [1]).

[1]) With "oceanic origin" is also meant the Flores-sea which has oceanic conditions. Dr. SUNIER, formerly head of the Laboratory for Investigation of the Sea, had come independently from me to the same conclusion, as he informed me by word of mouth.

When we consider now the lajang-catches in the western part of the Java-sea, the following may be seen, in a normal year. In the end of June or in the beginning of July the first catches are made, mostly of very young individuals. Gradually bigger animals are landed and the volume of the catches increases. The maximum lies in the months of July to August-September. A second maximum is found in the months of (December) January to February-March. In the interlying periods the lajang is scarce or totally lacking. This periodicity is of course not always so obvious. One of the periods of abundancy or scarcity may in itself be badly developed.

Considering the above we see that the periods of abundancy coincide with the times when east- and westmonsoon, which are the prevalent winds in the Java-sea, are strongest. The periods of scarcity coincide with the months in which the monsoons change. Considering this it is obvious that the periodicity of the lajang has something to do with the monsoons or rather with currents caused by these monsoons. About these currents the following may be remarked.

The Java-sea, which is hardly anywhere more than 50 - 60 meter deep, has about the shape of a rectangle. It is bounded on the East by the very deep Flores-sea. North and South it is bounded by Borneo and Java respectively and West by Sumatra (See the charts). Between these islands the Java Sea communicates in the western part through the Sunda Straits with the Indian Ocean and through the Banka-, Gaspar- and Karimata Straits with the South Chinese-sea. East- and West monsoon blow just about in the long axis of the Java-sea and it is obvious that these steady winds from one and the same direction during about six months of the year will cause a drift or current in the Java-sea which is directed westward in the east-monsoon and eastward during the westmonsoon.

During the eastmonsoon water flows into the Java-sea from the Flores-sea and partly also from the Macassar Straits, it leaves the Java-sea in its western part through the Sunda-, Gaspar- and Karimata Straits. The Banka Straits are too narrow and too much exposed to tides to be of any importance in this respect.

During the westmonsoon just the reverse takes place. Water flows into the Java-sea from the Indian Ocean through the Sunda Straits and from the South Chinese-sea through the Gaspar- and Karimata Straits and it flows out now into the Flores-sea. Calculations from the Meteorological Observations at Batavia (Dr. BERLAGE) showed that twice a year the Java-sea is completely swept clean.

The lajang lives in clear and deep water as has been said above, whereas the salinity must be higher than about 32 $^{0}/_{00}$. It is only in this water with its own particular plancton, that the lajang is generally found. Too little is known so far about its biology for the limits of the different conditions to be given more exactly. In the Java-sea mostly only immature or small mature individuals are found, if compared with the deeper surrounding seas. The

l a j a n g is generally caught not nearer than about 20 - 30 seamiles from the coast as it is only there that the conditions of salinity and composition of the plancton are fulfilled.

In the dry eastmonsoon the water in the Java-sea has in general a higher salinity than in the rainy westmonsoon when the big rivers of Sumatra and Borneo bring much fresh water into the sea. The abundancy of the l a j a n g is therefore much greater in the eastmonsoon than during the westmonsoon.

Let us now consider in detail the l a j a n g catches in the vicinity of Batavia. After a period of total or almost total absence in the end of June or in the beginning of July small lajang is caught east of the Thousand Islands. In the following weeks the l a j a n g becomes bigger whereas its number increases, if the eastwinds are regular and not too feeble. When the eastwinds cease and are replaced by the westwinds the l a j a n g will disappear again entirely or almost entirely, to reappear again in the full Westmonsoon in December or January. They are caught now much nearer to the coast than during the Eastmonsoon, for reasons which will be given below.

This disappearance and appearance of the l a j a n g together with the shifting of the fishing grounds can be explained easily when studying the east- and westmonsoon currents in detail.

During the Eastmonsoon clear water of a high salinity flows into the Java-sea from the Flores-sea and in the northern part waters out of the Macassar Straits are added to it. Most of this inflowing water leaves the Java-sea again through the Karimata- and Gaspar Straits, and for a smaller part only through the Sunda Straits and this for two reasons.

In the first place because the Gaspar- and Karimata Straits are much wider and much more water can pass through them than through the Sunda Straits and in the second place because the eastmonsoon is much stronger in the northern part of the Java-sea. But at any rate the Java-sea is slowly but surely filled with Floressea-water. The currents in the southern part of the Java-sea finds the Thousand Islands as a kind of barrier in its way and though it will partly go between the islands, most of it will flow around them north and south to the Sunda Straits.

The l a j a n g, living chiefly in the Flores-sea and adjacent seas with clear water of a high salinity, has in the Java-sea its western boundary about in the vicinity of Bawean. The current from the Flores-sea gradually fills up the Java-sea with water suitable to the l a j a n g and by and by the l a j a n g can extend its habitat in a western direction. I think that "extension" is the right word here as the shifting of the l a j a n g population into the Java-sea is not directed in itself, it has no meaning or purpose for the species but the fish simply swims into regions which thus far were more or less uninhabitable to him but have become more suitable now. It will be obvious that this westward movement will show itself in the first instance in the planctonic eggs and larvae, which are simply taken away with the currents. This explains the occurrence of young l a j a n g before the bigger ones arrive. This phenomenom

is not confined to the vicinity of the Thousand Islands (see above) but found elsewhere too and the more to the East earlier as can be expected.

When the Eastmonsoon gives way to the Westmonsoon the lajang will wander reversely into an eastward direction, since in the Westmonsoon the Java-sea will gradually be filled up with water of a lower salinity which is unsuitable to the lajang. Gradually but surely the lajang will be driven again to its original home in the eastern part of the Java-sea and beyond.

When considering now the currents in the Westmonsoon more in detail, we see in the first place a strong current coming out of the South Chinese Sea through the Gaspar and Karimata Straits. This currents bends to the East and flows South of the coast of Borneo where it will be strongest and as it will flow out more or less fanlike it will reach the Java coast too. This influence will be more obvious farther to the East. And as a matter of fact along the coast of Middle Java young lajang is caught before the bigger ones, just like during the East Monsoon (see below also).

From the Indian Ocean through the Sunda Straits a rather small current with clear water of a relatively high salinity comes into the Java-sea. This current flows quite near the northcoast of Java where it will find — as was the case with the currents from the East — the Thousand Islands as a barrier in its way. The Sunda Straits current has to divide into a southern and a northern branch. In each branch lajang can be caught in a greater or lesser quantity in the months from December to March. Just as in the east monsoon the lajang went westward it now goes eastward for the same reasons as given above. Parts of the Java-sea are becoming suitable to the lajang now by this Sunda Straits current.

From what has been said above two conclusions can be made:

1. In the Java-sea we have to distinguish at least two groups of lajang, which we may call provisionally east- and westlajang. In the Eastmonsoon it is therefore the eastlajang which comes into the Java-sea and this eastlajang moves from the East to the West. The Westmonsoon drives this eastlajang back again to the East, whereas westlajang now enters the Java-sea from the Sunda Straits moving to the east.

2. The fisheries of lajang are in the eastern part of the Java-sea fundamentally different from those in the western part. In the western half the fisheries are dependant from a stock of east- and of westlajang. We shall have a bad year when one of the two groups stays away or in other words, when one of the two groups does not move sufficiently to the East or to the West which will happen when West- or Eastmonsoon fails. The fisheries in the eastern part of the Java-sea depend only on the stock of eastlajang. Here also sometimes the lajang will wander to and fro somewhat, which may explain occasional periods of scarcity.

Whether the two groups of lajang are at any time separated from each other or whether their boundaries may be confluent or are even surpassing each other in some years is not quite known thus far. The solution of these

problems will depend from further studies. I suppose all three possibilities given above may be true. Analyses of the catches will serve us a good deal as the composition of the catches consisting mainly of lajang is not the same. The admixtures in the catches of east or westlajang are different in some cases. Furthermore race investigations should be started. This cannot be done however before the systematics of the genus have become entirely clear (see above).

Besides east- and westlajang there is perhaps a third group which is more or less hypothetical so far and which I will call northlajang. This northlajang will be found only in the Java-sea during the Westmonsoon and has its origin in the South Chinese-sea. During the Westmonsoon this group enters the Java-sea together with the currents of those months through the Gaspar- and Karimata Straits. In consequence this northlajang will have its main centre of distribution in the northern part of the Java-sea at some distance from the coast of South Borneo and from here it may gradually move southward where it may come in the vicinity of the Java coast. According to the currents this lajang will not be found along the north coast of West Java near Batavia and the Thousands islands, but it may occur near shores of middle Java.

I have the following arguments for a possible existence of this northlajang.

a. According to fishermen from Middle Java in some years young lajang may be caught in December or January, which is at first rather far out at sea but which gradually comes nearer. Later on bigger specimens are caught, which are the same phenomona as in the Eastmonsoon. It is obvious that this young lajang is now coming from the north or northwest in accordance with the currents. A West-East movement along the coast is not mentioned by the fishermen and therefore the lajang cannot have come with the Sunda Straits current. Moreover hydrographical observations show us that this current is not strong enough to manifest itself so far to the East.

b. During the Westmonsoon an about triangular patch of water of a lower salinity is found in the western part of the Java-sea. This triangle has its base on the shore line of Sumatra and Banka and its top at some distance east of Etnadroogte. No lajang is found in this patch of water. To the South near the Javacoast the westlajang will occur as has been shown above. To the North there are no regular fisheries but experimental fishing brought home some lajang. This lajang cannot be anything but northlajang. It cannot be westlajang as in that case it should have swum through a great distance of water not suitable to it and it is not likely too that the lajang should have rounded the top of the triangle coming from the South. Eastlajang it cannot be either as this group is in these westmonsoonmonths already far away to the East. So the only possibility is to assume a group of northlajang. How far this northlajang will

come eastward and whether it will mix with w e s t - or e a s t l a j a n g is of course not yet known. Further investigations will have to show this.

Summary:

1. The principal winddirections in the Java-sea are a consequence of the monsoons prevailing in these regions. The Eastmonsoon — better South-East-monsoon — prevails half a year from May to October and the Westmonsoon — better North-West-monsoon — the other six months.

2. The currents or drifts in the shallow Java-sea coincide with the monsoons. In the Eastmonsoon water of a high salinity flows from the Flores-sea into the Java-sea to leave it again through the Sunda Straits in the Southwest and through the Gaspar- and Karimata Straits in the Northwest. During the Westmonsoon the currents are just the reverse coming in through the above-named straits in the western part of the Java-sea and leaving it again in the East into the Flores-sea.

3. The l a j a n g (*Decapterus* species) is a fish living only in water of a rather high salinity (not lower perhaps than $32\,^0/_{00}$), not really at home in the Java-sea but which may live there, provided the conditions are suitable which is for instance the case when the above-named currents bring in water of a sufficient salinity.

4. In the Eastmonsoon a stock of so-called e a s t l a j a n g swims into the Java-sea from the Flores-sea, reaches its most western parts and may even leave it through the Sunda-, Karimata- and Gaspar Straits. This last however is only hypothetical so far.

5. In the Westmonsoon a stock of so-called w e s t l a j a n g enters the Java-sea through the Sunda Straits from the Indian Ocean. It will be found near the shores of West Java only.

6. In the Westmonsoon a stock of n o r t h l a j a n g may occur in the Java-sea too. This n o r t h l a j a n g will enter the Java-sea through the Gaspar- and Karimata Straits and has its origin in the South Chinese-sea. It is rather hypothetical thus far but some arguments speak in favour of its existence.

3. BEITRAG ZUR KENNTNIS DER INDO-MALAYISCHEN MALACODERMATA (COL.)

von

W. WITTMER,

Zürich.

Drilidae.

Platerodrilus rotundicollis nov. spec. Gelblich bis rötlichbraun, Augen, Fühler, Beine und Spitze der Flügeldecken und eine Verlängerung an der Naht dunkel.

Kopf mit den Augen bedeutend schmäler als der Halsschild, dicht und kurz behaart, mit kaum wahrnehmbarer Skulptur, Augen stark hervortretend. Fühler länger als der halbe Körper, 1. Glied länger als breit, zur Spitze verdickt, 2. und 3. Glied verkürzt, jedes fast doppelt so breit wie lang, 4. und 5. unter sich gleich lang, ca. 2½ mal so lang wie breit, 6. und folgende kaum kürzer, jedoch etwas schmäler werdend, 4. und 5., auch 6. und 7. Glied, jedoch in geringerem Masse, zur Spitze, besonders auf der Innenseite, leicht verdickt. Halsschild fast doppelt so breit wie lang, halbkreisförmig, Seiten erhoben, Behaarung ziemlich lang. Flügeldecken ca. 4 mal so lang wie an den Schultern breit, braun, die Spitzen und die Naht in der hinteren Hälfte, schwarz, mit 4 ziemlich deutlichen Rippen, die zur Spitze erlöschen, dazwischen verworren punktiert. Behaarung ziemlich dicht, etwas kürzer als die des Halsschildes.

Länge: 7 mm.

Fundort: M. Java, Batoerraden, G. Slamat, 26/29.5.1927 (leg F. C. Drescher). Mit *P. rufus* Pic, abgesehen, dass dieser einfarbig braun ist und die Flügeldecken mehr Längsrippen aufweisen, durch die ähnliche Halsschildform verwandt. Bei *rotundicollis* m. ist der Halsschild ausgesprochen halbkreisförmig, die Basalecken sind abgerundet. Bei *rufus* Pic sind die Vorderecken noch schwach erkennbar, währenddem die Basalecken spitz und deutlich ausgezogen sind.

Falsophrixothrix humeralis ab. **unicolor** nov. Unterscheidet sich von der Stammform durch einfarbig hellbraunen Halsschild.

Fundort: W. Java, G. Tangkoeban Prahoe, Juni 1934 (coll. F. C. Drescher).

Cantharidae.

Fissocantharis drescheri Pic. Einige Formen dieser Art, die in der Färbung von der Stammform abweichen, lassen sich wie folgt unterscheiden:

1. Halsschild schwarz 2
— Halsschild einfarbig orangebraun oder orangebraun mit dunkeln Makeln. 3

2. Flügeldecken einfarbig gelblichbraun .... *F. drescheri* Pic f.t.
— Flügeldecken gelblichbraun mit einer breiten schwarzen Makel an der Spitze. *F. drescheri* ab. *posticemaculata* nov.
3. Halsschild einfarbig orangebraun .... *F. drescheri* ab. *luteata* nov.
— Halsschild mit dunkeln Makeln 4
4. Seiten des Halsschildes mit schmalem, schwarzem Saum .... *F. drescheri* ab. *atromarginata* nov.
— Seiten des Halsschildes orangebraun, Scheibe mit zwei schlecht begrenzten, dunkeln Makeln .... *F. drescheri* ab *binotata* nov.

Die Flügeldecken der Aberrationen *luteata, atromarginata* und *binotata* sind einfarbig gelbbraun.

Rhagonycha Subgen. **Harmonycha** nov. Erstellt für R. *sulcicornis* Pic von Java, sowie für zwei weitere, neue Arten, beide auch von Java, die nachstehend beschrieben sind. Die drei Arten sind alle durch Auszeichnungen an den Fühlergliedern, die bei den Arten der Gattung *Rhagonycha* Eschsch. und deren Untergattungen *Armidia* Muls. und *Spartiolepta* Bourg. einfach sind, charakterisiert.

Rhagonycha (Subgen. **Harmonycha) torticornis** nov. spec. Braunschwarz bis schwarz, Mundteile, Unterseite des Kopfes teilweise, Vorderbrust, Vorderbeine bis auf die Schienen und Tarsen gelb oder gelblich. Von den Flügeldecken ist fast die ganze Basalhälfte gelb.

Kopf mit den Augen so breit wie der Halsschild, breiter als lang, glatt, mit brauner Behaarung, Augen hervortretend. Fühler kaum länger als der halbe Körper, 1. Glied langgezogen, so lang wie das 2. und 3. zusammen, 2. breiter als lang, zur Spitze verdickt, 3. Glied etwas länger als das 2., seitlich von aussen gesehen so lang wie breit, zur Spitze stark, doppelzähnig verbreitert, der nach unten gerichtete Vorsprung ist etwas länger und weniger stumpf als der nach oben gerichtete, 4. Glied wenig länger als das 3., so lang wie breit, zur Spitze stark verdickt, besonders die obere Spitze stark entwickelt, oben abgeflacht zusammengedrückt, 5. Glied etwas kleiner als das 4., so gross wie das 3., in der Form, abgesehen von der geringeren Grösse, dem 4. entsprechend, mit dem Unterschied, dass die obere Spitze weniger stark abgeflacht ist, 6. und 7. Glied jedes ca. doppelt so lang wie breit, Seiten fast parallel, auf dem Rücken mit einem leicht gebogenen, strichförmigen Längskiel versehen, 8. bis 11. Glied normal, unter sich von gleicher Länge, jedes etwas länger als das 7. Glied.

Halsschild quadratisch, etwas breiter als lang, Seiten nach vorne leicht verengt, vor den Vorderecken leicht ausgebuchtet, Mittellinie besonders an der Basis deutlich sichtbar, hier selbst mit je einer Beule neben der Mittellinie, Scheibe fast glatt, nur die Haarpunkte sind sichtbar. Behaarung braun. Schildchen dunkelbraun. Flügeldecken ca. 4 mal so lang wie an den Schultern breit, körnig, teilweise etwas quergerunzelt, nur an den Schultern etwas glatter. Behaarung schräg abstehend, gelblich auf den hellen und schwärzlich auf den dunkeln Stellen. 1. und 2. Glied der Vordertarsen von gleicher Länge, 3. etwas

kürzer. 1. Glied der Hintertarsen um ⅓ länger als das 2., 3. fast um die Hälfte kürzer als das 2. Glied.

Länge 5 mm.

Fundort: S. Java, Noesa Kambangan, 6.8.1932 (leg. F.C. Drescher).

Von *R.* (*Harmonycha*) *sulcicornis* Pic. durch dunklere Flügeldecken und verschieden gebildete Fühler verschieden, die bei *sulcicornis* vom 3. bis zum 8. auf der Oberseite mit Längseindrücken versehen sind, beim 3. Gliede ist der Eindruck sehr schwach, die Spitzen der Glieder sind nach innen leicht verdickt. Bei *torticornis* m. besitzt kein Glied Eindrücke, die Glieder 3 - 5 sind lediglich an ihrer Spitze verdickt, besonders nach innen, 6 und 7 sind auf der Oberseite mit einem schmalen, leicht gebogenen Längskiel versehen und vom 8. Gliede an wieder normal. Das 1. Glied der Vordertarsen ist bei *sulcicornis* um ⅓ länger und auch etwas breiter als das 2, bei *torticornis* sind die beiden ersten Glieder der Vordertarsen gleich lang und auch gleich breit.

Rhagonycha (Harmonycha) unidentata nov. spec. Gelbbraun, Augen, Fühler vom 3. oder 4. Gliede an, Tarsen und hintere Hälfte der Flügeldecken schwarz.

In der Form des Kopfes, Halsschildes und der Flügeldecken mit *torticornis* übereinstimmend. Fühler etwas länger als der halbe Körper. 1. Glied etwas kürzer als das 2. und 3. zusammen, zur Spitze verdickt, 2. Glied kurz, ⅓ kürzer als das 3., zur Spitze verdickt, 4. Glied etwas länger und dicker als das 3., zur Spitze auf der Rückenseite mit einem zahnartigen Vorsprunge, davor leicht eingedrückt, 5. - 10. Glied einfach, unter sich sind diese Glieder von gleicher Länge, nur wenig kürzer als das 4., 11. um ⅓ länger als das 10. Schildchen gelb. 1. und 2. Glied der Vordertarsen gleich breit, 1. Glied eine Spur länger als das 2

Länge: 5 mm.

Fundort: O. Java, K.O. Blawan, Idjen-Plateau, 900 - 1500 m, 9.2.1936 (leg. H. Lucht).

Die Fühler, deren 4. Glied allein eine Auszeichnung aufweist und die helle Färbung lassen die Art von den beiden anderen leicht unterscheiden.

Malthodes (Subgen. **Falsomalthodes) reductocarinatus** nov. spec. Braun, Mundteile, Basalglieder der Fühler, Basal- und Vorderrand des Halsschildes und Beine gelb oder gelblich, Schienen der Mittelbeine und Schienen und Schenkel der Hinterbeine mehr oder weniger angedunkelt.

Kopf breiter als lang, Augen ziemlich stark hervortretend, Behaarung des Kopfes fein und kurz, kaum wahrnehmbar. Fühler von halber Körperlänge, hellbraun, 2 - 3 Basalglieder gelblich. 1. Glied am längsten, fast 2½ mal so lang wie das 2., 2. Glied kaum länger als das 3., 3. - 6. unter sich von gleicher Länge, ca. 1½ mal so lang wie breit, 7. - 10. unter sich gleich lang, wenig kürzer als die vorangehenden, 11. Glied doppelt so lang wie das 10., Spitze zugespitzt. Ausser der staubartigen, anliegenden Behaarung ist jedes Glied mit mehreren, längeren, abstehenden Haaren besetzt. Halsschild fast 1½ mal so breit wie lang,

braun mit aufgehelltem, gelblichem Vorder- und Basalrand, fast glatt, fein, greis behaart. Seiten nach vorne schwach verengt, Hinter- und Vorderecken abgestumpft, Seiten kurz vor den Vorderecken knötchenförmig erhoben. Flügeldecken breiter als der Kopf mit den Augen, 2½ mal so lang wie breit, ziemlich lang, greis behaart, Punktierung verworren, an der Basis mit kleineren, weniger tiefen an der Spitze mit grösseren und tieferen Punkten, Spitzen der Decken wulstartig verdickt, Wulst fast glatt, nur mit Haarpunkten besetzt. Die Flügel überragen die Decken.

Länge: 2,8 - 3 mm.

Fundort: W. Java, Preanger, G. Tangkoeban Prahoe, 1300 - 1600 m, 5.9.1928 (leg. F. C. DRESCHER).

Von den übrigen aus dem indo-malayischen Faunengebiete beschriebenen Arten durch einfarbig braune Flügeldecken verschieden. Von *M. kocki* PIC. der einfarbig schwarzen Halsschild und Flügeldecken besitzt, durch hellere Färbung beider Körperteile und kleinere, schmälere Gestalt, verschieden. Die Seitenerhebung am Halsschild ist bei *reductocarinatus* etwas kleiner als bei *kocki*.

Malthodes javanus nov. spec. Braun, Kopf bis auf die etwas dunkleren Schläfen, die beiden Basalglieder teilweise, besonders an den Spitzen und der Innenseite, Halsschild am Vorderrand in der Mitte, gelborange. Beine, bis auf die etwas dunkleren Schienen, gelb.

Kopf ziemlich breit, mit den Augen so breit wie die Flügeldecken an den Schultern, ohne wahrnehmbare Skulptur, Augengrösse normal. Fühler lang, ungefähr so lang wie der ganze Körper. 1. Glied verhältnismassig kurz, fast um die Hälfte länger als das 2., 2. und 3. von gleicher Länge, 4. - 11. unter sich von fast gleicher Länge, jedes ungefähr so lang wie das 1., die mittleren Glieder eher noch etwas länger als das 4. Halsschild kurz, fast doppelt so breit wie lang, nach vorne leicht verbreitert, ringsum gerandet, Basalrand und Rand der Vorderecken etwas breiter, leicht erhöht und deshalb deutlicher sichtbar, fast glatt, sehr fein behaart, in der Mitte mit deutlichem Längseindruck. Flügeldecken in der Art der *Ichthyurus* oder *Microichtyurus* verkürzt, jedoch regelmässig verschmälert, d.h. ohne die leichte Ausbuchtung am Nahtrande der Decken aufzuweisen, die fast allen Arten dieser beiden Gattungen eigen ist. Punktierung sehr fein, fast runzlig, Behaarung ziemlich dicht, kurz und greis. Flügel voll entwickelt, sie bedecken den ganzen Hinterleib und sind fast doppelt so lang wie die Flügeldecken.

Länge: 2 - 2,3 mm.

Fundort: W. Java, Preanger, Bandoeng, 2.9.1929 (leg. F. C. DRESCHER).

Leicht erkenntlich durch die fast glatten, einfarbigen und verkürzten Flügeldecken.

MALACHIIDAE.

Laius carinaticeps subspec. **reducta** nov. ♂ Der Kiel, der sich jederseits über den Augen von Scheitel bis zur Fühlerbasis erstreckt, ist nach innen, also gegen die Stirne, weniger scharf abgegrenzt als bei der Stammform. Stirne und

Scheitel erscheinen dadurch flacher. Die Stärke der Punktierung nimmt gegen die Kiele zu ab, woselbst der Kopf fast glatt erscheint, bei der Stammform ist die Punktierung auf den Seiten wie auch in der Mitte gleichmässig dicht und gedrängt. Die Fühler sind schwarz, nur die Spitze des ersten, die Unterseite des 3 - 5 mehr oder weniger gelb, das 2., verdickte, Glied ist gelb oder rötlichgelb gefärbt. Bei der Stammform sind nur die 3 - 4 Endglieder dunkler gefärbt.

Fundort: W. Java, Preanger, G. Tangkoeban Prahoe 18.2.1930 (leg. F. C. Drescher).

Laius drescheri nov. spec. ♂ Körper schwarz, matt, Kopf und Halsschild mit schwachem, grünlichem Schimmer, Flügeldecken mit je zwei gelblichen Flecken, von denen der hintere kleiner und leicht verblasst ist. Fühler gelb, Endglied schwarz. Beine schwarz, nur die beiden Vorderbeine bis auf die leicht verdunkelte Basis der Schenkel und Tarsenspitzen gelb. Kopf kürzer als der Halsschild, nach vorne stark verengt, mit den Augen breiter als dieser, Augen stark hervortretend. Jederseits neben den Augen mit einer grubenartigen Längsvertiefung versehen, die am Hinterrande des Kopfes am tiefsten, gegen die Stirne zu seichter und in der Mitte durch einen schwachen Querkiel in zwei Teile geteilt wird. Kopf runzlig gewirkt, Behaarung kurz, gelblich, anliegend.

Fühler länger als der halbe Körper. Erstes Glied keulenförmig, zur Spitze abgeflacht, so breit wie lang, 2. zweimal so lang wie das erste, stark verdickt, auf der Oberseite mit einer grubenartigen Vertiefung, daran anschliessend eine Lamelle, die über das erste Glied ragt und dieses fast verdeckt und auf der Innenseite mit einem kleinen Zahne versehen ist, 3. Glied klein, knötchenförmig, fast breiter als lang, 4. bis 9. langgestreckt, 7. das längste, 10 ca. 1½ mal so lang wie das 9., in der Mitte verdickt, breiter als die vorangehenden. Halsschild länger als breit, stark gewölbt, von der Mitte zur Basis leicht konisch verengt, Basis schwach, quer eingedrückt, runzlig gewirkt, Schagrinierung kaum stärker als die des Kopfes, Behaarung weisslich, kurz, fein und anliegend. Flügeldecken ca. 2½ mal so lang wie an den Schultern breit, zur Spitze leicht verbreitert, körnig gewirkt, Behaarung schwärzlich, ziemlich dicht, kurz und anliegend. Die vordere Makel ist gelblich, fast rechteckig, die Seiten werden jedoch nicht berührt, die hintere Makel ist kleiner, fast rund und in der Färbung etwas verblasst.

Länge: 2,5 mm.

Fundort: W. Java, Preanger, Radjamandala, G. Pantjalikan, (27.11.1936, 400 m (leg. F. C. Drescher).

Zu den Arten mit einfarbig dunklem Kopfe zu stellen (*L. rouyeri* Pic und *carinaticeps* Pic). Durch gelbe Vorderbeine, verdicktes Endglied der Fühler, lange, über das erste Glied ragende Lamelle des verdickten zweiten Gliedes und grünlich schimmernden Kopf und Halsschild verschieden.

Dem verdienstvollen Erforscher der Fauna Java's, Herrn F. C. Drescher in Bandoeng, gewidmet.

Laius fissispinus nov. spec. ♂ Schwarz, nur die Unterseite und die Grube auf der Oberseite des verdickten 2. Gliedes rötlich, Flügeldecken mit zwei hintereinander stehenden weissen Flecken versehen.

Kopf kaum länger als breit, mit den Augen so breit wie der Halsschild, Augen stark hervortretend. Stirne mit einer feinen Längserhebung, die sich von der Basis zur Mitte der Stirne erstreckt, Wange mit einer Grube dicht neben dem Auge, Chagrinierung sehr fein, matt. Behaarung staubartig, kaum wahrnehmbar.

Fühler länger als der halbe Körper. 1. Glied fast rechteckig, länger als breit, zur Spitze leicht verschmälert, 2. Glied stark verdickt, von oben gesehen fast rechteckig, nur wenig länger als breit, mit einem tiefen Eindrucke, der sich bis zur Basis erstreckt, auf der Aussenseite mit einem weiteren seichten Längseindrucke; an der Basis befindet sich ein nach innen gerichteter, dünner, ziemlich langer, sich zur Spitze verjüngender Dorn, der im rechten Winkel zum Gliedrande steht. Auf der Innenseite, an der Basis dieses Dornes entspringt ein dünnerer, haarförmiger Fortsatz, der kürzer als der Dorn selbst ist, mit diesem parallel verläuft und deshalb manchmal schwer zu sehen ist. Am Aussenrande, ebenfalls an der Basis, gegenüber dem beschriebenen Dorne, erhebt sich ein weiterer, ziemlich breiter (besonders an der Basis) Fortsatzt, der in der Mitte gespalten ist. 3. bis 10. Glied schnurförmig, 3. das kleinste, kaum länger als breit.

Halsschild ziemlich stark gewölbt, ca $1\frac{1}{2}$ mal so lang wie breit mit fast parallelen Seiten, Seiten nur schwach eingedrückt, zur Spitze etwas, zur Basis stärker verengt. Basaleindruck deutlich, Skulptur körnig, weniger deutlich als die der Flügeldecken. Behaarung weisslich, staubartig. Flügeldecken ca. $2\frac{1}{2}$ mal so lang wie an den Schultern breit, zur Spitze leicht verbreitert. Vordere Makel breiter als lang, hintere Makel leicht oval, fast rund. Skulptur körnig, Behaarung schwarz, kurz und anliegend, auf den Flecken hell. Beine mit ziemlich dicken Schienen.

Länge: 2,7 mm.

F u n d o r t: W. Java, Preanger, G. Tangkoeban Prahoe, 1300 - 1600 m, April 1936 (leg. F. C. DRESCHER).

Verwandt mit *L. carinaticeps* PIC von dem er sich hauptsächlich durch die Bildung des Kopfes und der Fühler unterscheidet. Der Kopf von *carinaticeps* weist jederseits eine scharfe Erhebung auf, die sich von den Seiten der Stirne neben den Augen zur Fühlerbasis erstreckt, die Grube auf der Wange fehlt. Bei *fissispinus* m. ist der Kopf einfach, dafür weisen die Wangen jederseits unter den Augen eine Grube auf. Die Fühler der neuen Art sind dunkel, das 2. Glied rechteckig, mit 2 Fortsätzen versehen, von denen der innere breiter und an der Spitze gespalten ist. Bei *carinaticeps* PIC sind die Fühler gelb bis auf 2 - 4 angedunkelte Endglieder, das verdickte 2. Glied ist fast oval mit einem sich langsam verjüngenden Forsatz am inneren Basalrande, die Basis ist eingedrückt.

FAUNA BURUANA

HETEROPTERA, FAM. PYRRHOCORIDAE.

von

H. C. BLÖTE,

(Rijksmuseum van Natuurlijke Historie, Leiden)

Bis jetzt ist noch keine einzige Art dieser Familie aus Buru verzeichnet worden, und auch mir sind ausser der TOXOPEUS'schen Ausbeute nur einige wenige Stücke dorther bekannt. Unter denen ist aber ein Stück einer Art, der in dieser Ausbeute fehlt, und zwar: *Ectatops gracilicornis* STÅL var. *buruanus* m. (Annals and Magazine of Natural History ser. 10, vol. IX, p. 590).

Die Artenzahl der aus Buru bekannten Pyrrhocoriden beträgt somit nur 8, von denen aber in der TOXOPEUS'schen Sammlung zwei neue vorliegen.

Ob diese auffällige Artenärme durch spätere Befunde kompensiert werden wird, lässt sich schwerlich voraussagen. Zwar liegen in der TOXOPEUS'schen Sammlung ziemlich viele Stücke vor, aber andernseits sind noch viele Arten auf naheliegenden Inseln indigen, so dass sich ihre Anwesentheit auf Buru vermuten lässt.

Subfam. Euryophthalminae, Trib. Physopeltini.

Genus Physopelta AM. & SERV.

Physopelta fimbriata STÅL.

Buru, L. J. TOXOPEUS, Station 1, 2 Juni 1921, ♂ u. ♀ in Copula; Station 9, 1-28 Juni 1931, Larve.

Physopelta gutta BURM. s. spec. **famelica** STÅL.

Buru, L. J. TOXOPEUS, Station 3, 17 - 23 März 1921, ein ♂.

Physopelta melanopyga nov. spec.

Im Habitus dem *P. gutta* BURM. ziemlich ähnlich, aber u. A. durch schwarzen Kopf, geschwärzten Clavus (vor Allem nahe dem Ende) und schwarzes Hinterleibsende auffallend. Grundfarbe stumpfrosa, der ganze Körper von seidenartigen, etwas goldig glänzenden Härchen bedeckt. Mitte des Pronotums graubraünlich, der Hinterrand schmal rotbraun, die Vorder- und Seiten-ränder breiter hellrot. Halbdecken mit am Ende grauem Clavus, und mit grossem, schwarzem Mittelflecken, der sowohl dem Vorder- wie dem Hinterrande des Coriums ziemlich breit berührt. Der Apikalmakel lässt die Spitze des Coriums frei. Membran

schwarz; zwei Querflecken nahe dem Basis und ein Makel bei der Coriumspitze gelblich durchscheinend, der Wndrand weisslich. Schildchen schwarz. Antennen schwarz, der Basalteil des vierten Gliedes (etwa $^2/_5$) weisslich. Schnabel gelb, gegen die Spitze braunlich. Unterseite des Thorax schwarz, Ränder der Hüftpfannen, Coxae, Trochanter, Bases der Femora und Tibiae gelblich, Beine sonst schwärzlich. Aussenrand der Orifizen graulichgelb. Bauch Rot, dass erste (sichtbare) Segment, der Basis des zweiten, kleine Querflecken auf den Seiten des dritten, vierten und fünften Segmentes, gegen die Bases und das sechsten und siebenten Segment mit den Genitalanhängen gänzlich schwarz. Abdomenrücken rötlich, der Basis graulich, das sechste Tergit und ein Flecken auf den vorhergehenden Tergite, der aber nicht auf den Connexivum übergeht, schwarz.

Das letzte Bauchsegment des ♂ weist einen Unterschied auf mit dem des *P. gutta* BURM. In beiden Arten trägt die Scheibe des Segmentes einen stumpfen Höcker, der aber bei *P. gutta* BURM. von einem hufeisenförmig gekrummten Eindruck zwischen diesen Höcker und den Aussenrand des Segmentes umgeben ist. Bei *P. melanopyga* hingegen ist von einem Eindruck nichts wahrnehmbar; der Segment ist zwischen Höcker und Aussenrand ganz flach.

Länge des ♂: 15½ mm; des ♀: 16½ mm.

Buru, L. J. TOXOPEUS, Station 5, April 1921, ein ♂ und ein ♀. Holo- und Allotypen. Ein wohl zu dieser Art gehörige Larve: Station 13, 27 August 1921.

Subfam. Pyrrhocorinae.

Genus Antilochus STÅL.

Antilochus discoidalis BURM. var **angulifer** WALK.

Buru, L. J. TOXOPEUS, Station 1, Januari 1922, ein ♂ und ein ♀; Station 1 u. 2, 12 Dezember 1921, Larve; Station 7, Ende September 1921, Larve.

Genus Dindymus STÅL.

Dindymus buruensis nov. spec.

In vielen Hinsichten dem *D. amboinensis* F. ähnlich, aber leicht davon zu unterscheiden durch den gänzlich schwarzen Pronotum. Kopf und Thorax schwarz, ziemlich glänzend, das Schildchen matt. Vordere und mittlere Hüftpfannen und die Hinterränder des Pro- und Mesosternums gelblich; fein und weitläufig schwarz punktiert. Bauch gelblichrot, nur das erste (sichtbare) Sternit mit Ausnahme der Seiten schwarz. Halbdecken mit schwarzer Basalhälfte und Membran; das Coriumende rot. Zuweilen breitet sich die schwarze Farbe mehr aus, sodass nur die aussere Apikalpartie des Coriums noch rötlich ist. Antennen schwarz, etwa $^4/_5$ der Körperlänge; viertes Glied mit weissem Basalteil. Schenkel schwarz, Schienen und Tarsen graulichgelb bis braun.

Das letzte Sternit des ♂ zeigt am Hinterrande eine lamellenartige, mehr oder weniger trapeziumförmige Auswuchs, der zwei Eindrucke trägt, mit eine ziemlich deutliche Längswulst dazwischen. Auf der Scheibe des Segmentes, knapp

unter die Auswuchs des Hinterrandes befindet sich ein Quereindruck, der an den Seiten undeutlich wird.

Bei der verwandte *D. amboinensis* F. zeigt die Lamelle am Hinterrande des letzten Sternits beim ♂ keine Eindrucke und kein Längswulst.

Länge des ♂: 9⅓ - 10½ mm; des ♀: 11 - 13⅔ mm.

Buru, L. J. Toxopeus, Station 4, März 1921, eine Larve; Station 5, April 1921, ein ♂ (Paratypus); Station 7, 800 - 1300 m, 25 April 1921, ein ♂ (Paratypus); Station 8, 25 - 26 April 1921, ein ♂ (Paratypus); Station 9, 8 Mai 1921, ein ♂ und ein ♀ (Paratypen); Station 9, 1 - 28 Juni 1921, eine Larve; Station 11, 950 m, 23 - 24 Juni 1921, ein ♂ (Paratypus); Station 9, 1 - 19 Juli 1921, ein ♂ und drei ♀♀ (Paratypen); Station 13, 28 Augustus - 4 September 1921, ein ♀ (Paratypus); Station 7, Ende September 1921, zwei ♂♂ (Holo- und Paratypus) und neun ♀♀ (Allo- und Paratypen); Station 1, Januar 1922, ein ♀ (Paratypus); Station 8, Februar 1922, ein ♂ und zwei ♀♀ (Paratypen); Buru, zwei ♀♀ (Paratypen) im British Museum, (ein Stück mit monstruoser, dreigliedriger Antenne).

Genus Dysdercus Am. & Serv.

Dysdercus cingulatus F.

Buru, L. J. Toxopeus, Station 1, 10 Februar - 16 März 1921, ein ♀; Station 5, April 1921, zwei ♂♂, drei ♀♀ und eine Larve; Station 4, 15 April 1921, zwei ♂♂ und ein ♀; Station 9, 1 - 28 Juni 1921, vierundzwanzig ♂♂, zwanzig ♀♀ und zwölf Larven; Station 13, 28 August - 4 September 1921, ein ♀; Station 4, 29 - 31 Januar 1922, zwei ♂♂ und vier ♀♀; Station 8, Februar 1922, ein ♂.

Dysdercus cruciatus Montr.

Alle mir vorliegende Stücke gehören zur Varietät mit einfarbig gelbem Corium.

Buru, L. J. Toxopeus, Station 1, 10 Februar - 16 März 1921, acht ♂♂ und sechs ♀♀, darunter drei Pärchen in Copula.

SOME NEW OR RARE FISHES OF THE INDO-AUSTRALIAN ARCHIPELAGO VI [1])

by

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(Laboratorium voor het Onderzoek der Zee, Batavia).

Fam. SILURIDAE.

BELODONTICHTHYS Bleeker.

Belodontichthys javanensis nov. spec.

B.15; D.4; A.60; P.I.14; V.9.

Head depressed, body compressed. Height about 3.8, head 3.9 in length [2]). Eye 7.5 in head, 4 in postorbital part. Eye above corner of mouth. Anterior nostrils, near upperlip, tubular. Tubes of posterior ones very short. Breadth of head about as long as postorbital part. Dorsal profile of preserved specimen somewhat convex with a small concavity above the eyes. Lower jaw longer than upper. Teeth in jaws widely set, slender, in five to six irregular rows. The innermost ones are the largest. Teeth on vomer very few, in a single transverse row, very small. None on palatines. Maxillary barbels long and slender, slightly surpassing pectorals. Mandibulary barbels situated far backwards, not so long as diameter of eye. Pectorals as long as head without half the snout. Pectoral spine, which is rather strong, somewhat shorter than postocular part of head. Ventrals about as long as snout. Length of anal more than half the length of head and body. Caudal deeply forked, the lobes pointed, equally long. Dorsal as long as postorbital part of head. Colouration a mottled black above, whitish below. All fins powdered with black. Faint black blotch on lateral line behind gillopening.

One specimen of a total length of 215 mm, from freshwater. Fishmarket of Batavia, 7-9-'36. Easily distinguishable from *Belodontichthys dinema* (Blkr.) by the low number of anal rays.

Fam. THERAPONIDAE.

HELOTES C.V.

Helotes sexlineatus (Q. and G.).

D.XII.10; A.III.10; P.14; V.I.5; L.l.85; L.tr.15-1-'28.

Height 3.5, head 3.8 in length. Rostro-dorsal profile slightly convex. Eye rather large, somewhat more than thrice in head, more than once in snout. Praeorbital entire, covering largest part of maxillary when mouth is closed.

[1]) Cf. Treubia XIII, p. 411; XIV, p. 215; XIV, p. 287; XV, p. 131; XV, p. 367.
[2]) With length is always meant the length of head and body, with the caudal fin excluded.

Nostrils approximate, the anterior tubulate, the posterior triangulate. Gape of mouth small, jaws equal, lips thin. Maxillary not quite reaching to eye. Praeoperculum denticulate, stronger at the rounded angle. Operculum with two spines, the lower one the strongest, surpassing the opercular lobe. Coracoid truncate and roughly denticulate. Teeth in jaws, brown coloured, in several irregular series. The outer series enlarged, brown aud trilobate. None on vomer and palatines. Spinous dorsal emarginate, the ultimate spine longer than the penultimate, about half as long as the fourth and fifth rays, which are longest and which are somewhat larger than eye and snout, much higher than the soft dorsal, which is somewhat concave. Third anal spine subequal to second. Soft anal as long and as high as soft dorsal. Each fin with a low scaly basal sheath Caudal faintly emarginated, the lobes more or less rounded. Pectorals obtuse, somewhat shorter than ventrals and somewhat shorter than head without snout. Colour when alive greyish-brownish above, silvery below, 4 - 5 dark longitudinal bands. The first one along the back just below the spinous dorsal. The second from the shoulder, just above the lateral line to the middle of soft dorsal. The third one from tip of snout through eye to upper half of caudal. The fourth one from end of maxillary to lower half of caudal, just above pectorals. The fifth one which is more or less incomplete begins below the pectorals. A black spot on shoulder. Top of dorsal more or less blackish and also its base. Caudal with a dark border and a faint intermediate and basal transverse band. Other fins more or less hyaline.

Rather common in the Bay of Batavia. The same seems to be the case in the vicinity of Singapore. The species has probably a much wider distribution in the archipelago than one would judge from literature. It is easily mistaken for a Therapon species.

Literature:

1. *Terapon sexlineatus*. QUOY and GAIMARD. Voy. Uranie et Physicienne 1824, p. 340.
2. *Helotes sexlineatus* BLEEKER, Nat. Tijdschr. Ned. Indië II, 1851, p. 171.
3. *Helotes sexlineatus* GÜNTHER, Cat. Brit. I. 1859, p. 285.
4. *Therapon, (Helotes) sexlineatus* BLEEKER, Révis. Therap. Ned. Tijdschr. Dierk. IV, 1873, p. 392.
5. *Therapon (Helotes) sexlineatus* BLEEKER, Atl. Ichth. VII, 1873 - 1876, p. 118.
6. *Helotes sexlineatus* WEBER and DE BEAUFORT, Fishes of the Indo Australian Archipelago VI, 1931, p. 166.

Fam. EMMELICHTHYIDAE.

DIPTERYGONOTUS BLKR.

Dipterygonotus leucogrammicus BLKR.

D.XIV.I.9; A.III.8; P.15; L.l. ± 80; L.tr.10-1-18.

Oblong. Height 5.1 in length, head 3.7, conical. Eyes about 4 in head, about once in snout and in interorbital space. A narrow adipose eyelid present.

Nostrils distant, the anterior somewhat tubular, the posterior quite near vertical through frontborder of eye. Praeoperculum with a vertical hindborder, the rounded angle finely denticulate. Operculum with a flat spine. First dorsal originating above middle of pectorals. The 10 anterior spines of dorsal united by a membrane, the second, third and fourth longest. The four posterior spines short, isolated, with a short triangular membrane. Soft rayed dorsal much shorter than spiny dorsal and less high. First spine of anal short, the second and third longer and subequal. Anal rays as high as dorsal ones. Pectorals as long as postorbital part of head and half eye. Ventrals originating below anterior half of pectorals, as long as postorbital part of head. Caudal deeply incised, somewhat shorter than head without snout. Colour of specimen in formaline grayish-brownish above, silverish below. Two or three faint longitudinal whitish bands on body. The upper one just above the lateral line and continued on head to the eye.

One specimen with a total length of 95 mm from the Java Sea, west of the island Bawean. May 1936. Found in a catch consisting mainly of *Decapterus*. A few others of about the same length from Sabang and the island Buton.

Literature:

1. *Dipterygonotus leucogrammicus* BLEEKER, Journ. Ind. Archipelago III, 1849, p. 71.
2. *Emmelichthys leucogrammicus* BLEEKER, Nat. Tijdschr. Ned. Indië I, 1850, p. 103.
3. *Erythrychthys leucogrammicus* GÜNTHER, Cat. Brit. Mus. I, 1859, p. 396.
4. *Dipterygonotus leucogrammicus* BLEEKER, Arch. neérl. Sc. nat. VIII 1873, p. 158.
5. *Dipterygonotus leucogrammicus* BLEEKER, Atlas Ichthyologique VIII, 1876-77, p. 42.
6. *Emmelichthys leucogrammicus* EVERMANN and SEALE, Bull. Bureau Fishes XXVI, 1906, p. 71.
7. *Emmelichthys leucogrammicus* M. WEBER, Siboga Exp. Fische, 1913, p. 275.

Fam. LEIOGNATHIDAE.

LEIOGNATHUS LACÉPÈDE.

Leiognathus elongatus (GTHR.).

D.VIII.16; A.III.14; P.I.16; V.I.5.

Body elongate. Dorsal and ventral profile about equally convex. Height 3.2 in length, head 3.5. Eye about 3.5 in head, about once in postorbital part of head. Minute spine above the anterior margin of the orbit. Tube of snout directed downwards when protracted. Cheeks scaly, opercles naked. Lower praeopercular margin very finely serrated. Body totally scaled. Lateral line conspicuous, its course somewhat more flattened than dorsal profile. Second and third dorsal spine longest, 2.2 in greatest height of body. Total length of dorsal

somewhat less than twice in length of head and body. Second and third anal spine subequal in length. Second spine by far the strongest, longer than postorbital part of head. Pectoral spine very weak. Pectoral somewhat shorter than head without snout. Ventral spine strong, about as long as eye.

Two specimens of about 8 and 14 cm (tail damaged), from an old collection of the fisheries-investigation steamer "Gier". Date 24-2-1907. Locality 5°5′ S.L. and 107°38′ E.L. (Java Sea).

Literature:

1. *Equula elongata* GÜNTHER, Ann. Mag. Nat. Hist. (4) XIV, 1874, p. 369.
2. *Leiognathus stercorarius* EVERMANN and SEALE, Bull. Bur. Fish. XXVI (1906) 1907, p. 67.
3. *Leiognathus elongatus* WEBER and DE BEAUFORT, Fishes of the Indo-Austr. Archip. VI, 1931, p. 318.

Fam. MULLIDAE.

PARUPENEUS BLEEKER.

Parupeneus trifasciatus (LAC.) **bimaculatus** new colour variety.

D^1 VIII, D^2 I.8; A.I.6; P.I.15; L.l.30; L.tr.2½-1-6½.

Oblong and compressed. Dorsal profile more convex than ventral, especially between snout and first dorsal. Height below origin of first dorsal 3.2 in length. Rostrodorsal profile nearly straight, with a slight concavity, ascending and continued in convex dorsal profile. Head 3.2 in length, rather acute, much longer than high. Eye 5.5 in head, about 3 in snout, about 1.5 in postorbital part, situated in upper third of head. Mouth small, terminal, lower jaw somewhat included. Upper lip not very thick. Chin strong, rounded. Maxilla rounded behind, its terminal width about 1.5 the diameter of the eye. Barbels nearly reaching ventrals. Head scaly. Scales reaching to nostrils, only the praeorbitals are scaleless. First dorsal spine minute, third spine longest about 1.4 in head, when depressed surpassing origin of second dorsal. Interspace between both dorsals covered by two scales, its length more than thrice in length of first dorsal. Second dorsal as long as first, its last ray produced, reaching caudal. Anal as long as second dorsal its last ray produced. Ventrals shorter than head but much longer than pectorals. Caudal much shorter than head, the lobes rather obtuse. Colour when fresh brownish with a yellowish hue. A blackish blotch behind eye. A faint black stripe from eye to point of snout. Pectorals transparent, yellowish. Ventrals with a blackish outer border. Dorsal with a black base, the upper part with horizontal yellow lines, the prolonged ray black. Anal with longitudinal blackish and yellowish lines. Caudal with a small black dorsal and ventral border. A black blotch on caudal peduncle confluent over the dorsal profile with the blotch on the other side, reaching 1.5 to 2 scales below lateral line, three to four scales broad and two scales apart from second dorsal. A second black blotch below second dorsal reaching 0.5 to 1 scale below lateral line, extending from third to seventh dorsal ray.

One specimen from the Straits of Macassar, (exact locality unknown) bought from Japanese fishermen at the fishmarket of Batavia. Total length 21 cm. September 1936.

This specimen is exactly alike to *Parupeneus trifasciatus*, only the first black band or blotch is lacking. Yet it is not the variety *atrocingulatus* KNER, which is figured by GÜNTHER is his „Fische der Südsee" as the two black bands in the lastnamed are situated in quite other parts of the body. My specimen is also quite distinct from *Parupeneus bifasciatus*, having the maxillary broader than the eye and the last dorsal and anal rays prolonged.

Literature:

1. *Mullus trifasciatus* LACÉPEDÈ, Hist. Nat. Poissons III, 1802, p. 404.
2. *Parupeneus trifasciatus* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago VI, 1931, p. 382.

Fam. LUTJANIDAE.

APHAREUS CUVIER and VALENCIENNES.

Aphareus rutilans C.V.

D.X.11; A.III.8; P.2.14; V.I.5; L.t.73; L.tr.8-1-19.

Oblong. Height 3.5. Head 3.2 in length. Eye 4.5 in head, about 1.5 in snout. Mouth large oblique. Chin strong, prominent. Maxillary reaching to below hindborder of pupil. A few rows of very small teeth anteriorly in upper jaw, one row in lower jaw and on sides of upper jaw. Palate toothless. Scales beginning on head, above posterior part of eyes with a median triangular prolongation, the blunt point of which is directed forwards and wedged in between the two supratemporal scaly patches. Eight transverse rows of scales on praeoperculum, the posterior and inferior limb of which is naked. Hindborder of praeoperculum smooth. 22 scales before dorsal. Dorsal spines weak and flexible but pungent. First spine about half as long as second. Third spine somewhat shorter than postorbital part of head. Last dorsal ray prolongated, about as long as snout and eye. First anal spine short, shorter than second. Third spine somewhat longer than second, about 1.5 the diameter of the eye. Last anal ray extended like last dorsal ray. Pectorals pointed, somewhat falcate, somewhat shorter than head. Ventrals pointed, as long as head without snout. Caudal forked. Least height of caudal peduncle about twice in its length. 32 gillrakers on lower branch of first gillarch. Colour blackishreddish when alive.

One specimen of an approximated length of 38 mm (tail damaged from Pelabuan Ratu) Wijnkoopsbay, Southcoast of Java. August 1933. The paired fins of my specimen are somewhat longer than as mentioned in literature.

Literature:

1. *Aphareus rutilans* CUVIER and VALESCIENNES, Hist. Nat. Poissons VI, 1830, p. 490.
2. *Aphareus rutilans* KLUNZINGER, Fische des rothen Meeres I, 1884, p. 45.

3. *Aphareus furcatus* BLEEKER, Atl. Ichth. VIII, 1873, p. 80.
4. *Aphareus rutilans* FOWLER, Mem. B. P. Bishop Mus. X, 1928, p. 195.
5. *Aphareus rutinans* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago VII, 1936, p. 320.

LUTJANUS BLOCH.

Lutjanus semicinctus Q.G.

D.X.13; A.III.8; P.2.14; V.I.5; L.l.48; L.tr.5½-1-17.

Height 3.2, head 2.6 in length. Eye 5 in head, 1.9 in snout, about once in interorbital space. Mouth somewhat oblique. Maxillary reaching to below frontborder of eye or somewhat before it. Small teeth in narrow bands in jaws with an outer series of enlarged ones. In the upper jaw anteriorly one canine on each side. Temporal region naked. Scales on occiput beginning far behind eye. About six transverse rows of scales on praeoperculum. Posterior and inferior preopercular limb naked. Posterior and inferior border of preoperculum smooth or with very fine denticulations. Preopercular notch shallow. Longitudinal rows of scales on body above lateral line running obliquely, ascending to dorsal profile; parallel to axis of body below lateral line. Fourth dorsal spine longest, about equal to snout. Soft dorsal low, rounded. Second and third anal spine subequal, somewhat longer than eye, much less high than almost truncate soft anal. Pectorals about as long as head without half snout. Ventrals equal to postorbital part of head. Caudal only slightly emarginate. Eight broad transverse bands on back, tapering towards belly. The last very broad one on caudal peduncle.

On specimen with a total length of 260 mm from Macassar (Celebes) 1932.

Literature:

1. *Lutjanus semicinctus* QUOY and GAIMARD, Voyage de l'Uranie et de la Physicienne, Zool. 1824, p. 303.
2. *Mesoprion semicinctus* BLEEKER, Nat. Tijdschr. Ned. Indië V, 1853, p. 331.
3. *Mesoprion semicinctus* GÜNTHER, Fische der Südsee I, 1873 - 1875, p. 15.
4. *Lutjanus semicinctus* BLEEKER, Atl. Ichth. VIII, p. 63.
5. *Lutjanus semicinctus* FOWLER, Mem. B. P. Bishop Mus. X, 1928, p. 198.

Lutjanus rangus (C.V.).

D.X.13; A.III.8; P.2.14; V.I.5; L.l.50; L.tr.6½-1-28.

Height 3.0 in length. Head 2.7. Eye 3.7, 1.2 in snout, its long axis oblique. Mouth oblique. Maxillary reaching to below frontborder of eye. Small teeth in narrow bands in jaws with an outer row of enlarged ones, in upper jaw one canine on each side. Teeth on vomer in a more or less diamond shaped patch, with short lateral prolongations. A single row of very small teeth on palatines. Head naked anteriorly. Scales on occiput beginning behind eye. Six transverse rows of scales on preoperculum. Posterior and inferior border of preoperculum naked. Preopercular notch shallow. Preoperculum finely dentated.

Longitudinal rows of scales above lateral line running obliquely and ascending to dorsal profile, those below lateral line parallel to axis of body. Fourth and fifth dorsal spine longest, equal to postorbital part of head. Soft dorsal rounded. Second and third anal spine subequal, somewhat shorter than snout. Pectorals somewhat longer than head without snout. Ventrals equal to postorbital part of head and half eye. Caudal slightly emarginate. Colour when alive reddish brownish with yellow longitudinal lines.

One specimen of a total length of 215 mm from Pelabuan Ratu (Wijnkoopsbay-South coast of Java) 1933.

Literature:

1. *Mesoprion rangus* Cuvier and Valenciennes, Hist. Nat. Poissons II, 1828, p. 482.
2. *Mesoprion rangus* Bleeker, Nat. Tijdschr. Ned. Indië XVII, 1858 - 1859, p. 154.
3. *Mesoprion rangus* Günther, Cat. Brit. Museum I, 1859, p. 199.
4. *Lutjanus rangus* Bleeker, Verh. Akad. Amsterdam XIII, 1873, p. 59 Atl. Ichth. VIII, 1876 - 1877, p. 65.
5. *Lutjanus rangus* Weber and de Beaufort, Fishes of the Indo-Australian Archipelago VII, 1936.

SCOLOPSIS Cuvier.

Scolopsis inermis Schl.

D.X.9; A.III.7; P.2.14; V.I.5; L.l.36; L.tr.2½-1-11.

Height 2.8, head 3.1 in length. Eye 3 in head, somewhat more than snout. Interorbital space flat, 1.2 in eye. Scales beginning above posterior part of eyes. Maxillary smooth, reaching to below frontborder of eye. Slender teeth in bands in jaws, the outer row somewhat enlargened. Six rows of scales on preoperculum, the hindborder of which is not scaled and is finely denticulated. Suborbital spine small but distinct. Five or six minute spines below it. First dorsal spine more than half of second. Third and fourth spine largest, equal to snout and half eye. Tenth spine somewhat longer than snout. Soft dorsal rounded, slightly higher than spinous part. First anal spine about half as long as second. Second and third spines subequal, slightly more than eye. Soft anal higher than spinous part, rounded. Pectorals longer than head without half of snout. Ventrals with the first ray produced, somewhat longer than head without snout. Caudal emarginate. Least height of caudal peduncle 1.7 in its length. Colour of specimen in formaline, brownish with faint indications of darker longitudinal bands.

One specimen of a total length of 200 mm. Pelabuan Ratu (Wijnkoopsbay, Southcoast of Java) 1933.

Literature:

1. *Scolopsides inermis* Schlegel, Fauna Japonica, Poissons, 1843, p. 63.
2. *Scolopsides inermis* Bleeker, Verh. Bat. Gen. XXVI, 1854 - 1857 Nieuwe nalez. Ichthyol. Japan, p. 83.

3. *Scolopsis inermis* GÜNTHER, Cat. Brit. Mus. I, 1859, p. 357.
4. *Scolopsis inermis* BLEEKER, Ned. Tijdsch. Dierk. IV, (1872) 1873, p. 352 Atl. Ichth. VIII, 1876 - 1877, p. 4.
5. *Scolopsis inermis* KLUNZINGER, Fische des rothen Meeres I, 1884, p. 32.
6. *Scolopsis inermis* FOWLER, Bull. U. S. Nat. Mus. Vol. XI, 1931, p. 274.
7. *Scolopsis inermis* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago VII, 1936, p. 330.

NEMIPTERUS SWAINSON.

Nemipterus celebicus (BLKR.).

D.X.9; A.III.7; P.2.14; V.I.5; L.l.49; L.tr.3-1-10.

Oblong. Profile of head a little convex. Height of head measured in vertical through hindborder of praeoperculum equal to length of head without half the breadth of the operculum. Height 3.5 in length, head 3.5. Eye almost 4 in head, 1.5 in snout. Interorbital space somewhat concave, about once in eye. Mouth oblique, maxillary reaching to below frontborder of eye. Lower jaw slightly included. A narrow band of teeth in upper jaw with an outer row of larger ones. In the intermaxillaries the band of teeth is broader with six curved canines in front. In the lower jaw the inner band of small teeth is developed only anteriorly with six canines in front of it. A row of enlarged teeth on the sides. Suborbital as high as vertical diameter of eye, its posterior angle rounded, its hindborder forming a straight line, which when continued reaches the dorsal profile 5 scales before the origin of dorsal. Naked limb of praeoperculum about half the depth of the scaly part. Hindborder of praeoperculum finely denticulated to crenulated. Scales beginning on head between eyes, with an illdefined temporal band. Dorsal spine rigid and pungent. Spines gradually increasing in length posteriorly. Membrane between the spines only slightly notched. Soft dorsal not or only slightly higher than spinous part of dorsal. First anal spine more than half length of second, which is slightly shorter than third and about equal to eye. Anal spines shorter than dorsal ones. Anal rays longer than spines. Soft anal pointed behind, soft dorsal more rounded. Pectorals somewhat shorter than head. The ventrals have the first ray prolonged, as long as pectorals. Reddish, silvery below when alive. A broad yellow band from snout through eye to base of caudal. Narrow longitudinal yellow bands on dorsal and anal.

One specimen of a total length of about 30 cm (tail damaged!) from Pelabuan Ratu (Wijnkoopsbay, Southcoast of Java).

Literature:

1. *Dentex celebicus* BLEEKER, Nat. Tijdschr. Ned. Indie VII, 1854, p. 245.
2. *Synagris celebicus* GÜNTHER, Cat. Brit. Mus. I, 1859, p. 377.
3. *Dentex celebicus* BLEEKER, Verh. Akad. Amsterdam XIII (1872) 1873 Révision Dentex, p. 19. Atl. Ichth. VIII, 1876 - 1877 p. 88.
4. *Synagris celebicus* KLUNZINGER, Fische des rothen Meeres I, 1884, p. 36.
5. *Nemipterus celebicus*. WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago VII, 1936, p. 363.

Nemipterus sumbawensis (BLKR.).

D.X.4; A.III.7; P.2.16; V.I.5; L.l.47; L.tr.3-1-12.

Height 3.6. Head 3.3. Height of head measured in vertical through hindborder of praeoperculum about equal to length of head without operculum. Eye 3.1, equal to snout. Interorbital space 1.3 in eye. Maxillary reaching a little further than frontborder of eye. Narrow bands of small teeth in anterior part of jaws. In the upper jaw an outer row of somewhat enlarged teeth and 2 moderate canines on each side anteriorly. In the lower jaw an outer row of rather strong enlarged teeth, those in front somewhat shorter, no canines. Suborbital emarginate, its depth more than twice in the vertical diameter of the eye, its hindborder when produced reaches the dorsal profile. 6 scales before origin of dorsal. Hindborder of praeoperculum finely denticulated. Depth of naked limb of praeoperculum somewhat more than twice in scaly part. Dorsal spine rigid. The membrane between the spines only slightly emarginate. Spines slightly increasing from first to last, which is as long as eye and half snout. Soft dorsal higher than spinous part, its hindborder rounded. First anal spine more than half length of second, third longest, equal to horizontal diameter of eye. Soft anal rays higher than third spine. Soft anal pointed behind. Pectorals about half length of snout shorter than head. Ventrals with first ray produced, only little shorter than pectorals. Caudal forked. Upper lobes produced into a filament. Colour of specimen in formaline, reddish brown above, silvery below.

One specimen of a total length (filament of dorsal lobe included) of 265 mm. Differing from the description given by WEBER and DE BEAUFORT by having the linea transversalis 3-1-13 instead of 3-1-10. Pelabuan Ratu (Wijnkoopsbay, Southcoast of Java) 1933.

Literature:

1. *Dentex sumbawensis* BLEEKER, Nat. Tijdschr. Ned. Indië XIX, 1850, p. 439. Verh. Akad. Amsterdam XIII (1872), 1873. Révision Dentex, p. 35, Atl. Ichth. VIII, 1876 - 1877, p. 94.
2. *Nemipterus sumbawensis* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago VII, 1936, p. 377.

Nemipterus nematophorus (BLKR.).

D.X.9; A.III.6; P.I.15; V.I.5; L.l.48; L.tr.3½-1-11.

Height 2.9 in length, head 3.1 Height of head measured in vertical through hindborder of praeoperculum, half length of operculum less than length of head. Eye 3 in head, somewhat more than snout. Interorbital space flat, 1.5 in head. Mouth oblique, maxillary reaching to below frontborder of pupil. Narrow bands of teeth in each jaw with a regular outer row of larger ones. At the symphysis of the upper jaw about six canines. Suborbital low, its depth about half the vertical diameter of the eye, its posterior angle rounded. Its hindborder forms a more or less straight line, which when produced reaches the dorsal profile 7 scales before origin of dorsal. Borders of praeoperculum almost smooth. Depth of naked limb about twice in that of the scaly part. Scales beginning on head

above posterior half of eye. Dorsal spines flexible, not pungent, the first and second longest, produced in a very long and soft filament. Soft part of dorsal higher than spinous part (filaments excepted), pointed behind and rounded above. Anal rounded behind, pointed above, less deep than soft dorsal. Pectorals pointed almost as long as head. Ventrals with the produced outer ray almost as long as pectorals. Caudal deeply forked. Upper lobe produced into a filament. Least height of caudal peduncle 1.6 in its length. Colouration of alcohol-specimen entirely faded.

One specimen of a total length of 140 mm in an old collection from the fisheries investigation steamer "Gier" 19-10-'08. Locality 5°39′ S.L., 111°19′ E.L. (Eastern part of the Java Sea).

Literature:

1. *Dentex nematophorus* BLEEKER, Nat. Tijdschr. Ned. Indië V, 1853, p. 500.
2. *Synagris nematophorus* GÜNTHER, Cat. Brit. Mus. I, 1859, p. 379.
3. *Dentex nematophorus* BLEEKER, Verh. Akad. Amsterdam XIII (1872) 1873, Révision Dentex p. 23. Atl. Icht. VIII, 1876 - 1877, p. 90.
4. *Synagris nematophorus* FOWLER, Bull. U.S. Nat. Mus. Vol. XII, 1933, p. 113.
5. *Nemipterus nematophorus* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago VII, 1937, p. 366.

EINE NEUE RASSE VON ARBOROPHILA BRUNNEOPECTUS AUS JAVA

(mit einer Anmerkung über A. b. bartelsi Siebers).

Von

M. BARTELS jr.

(Soekaboemi, Java).

Arborophila brunneopectus lawuana subsp. n.

Unterscheidet sich durch folgende Merkmale von *A. b. javanica* (Horsf.) und *A. b. bartelsi* Siebers: *Es fehlen die beiden bräunlichgelben Flecken am Hinterkopf;* der Oberkopf ist dunkler, mehr graubraun (weniger gelbbraun); der sich nach hinten verbreiternde schwarze Superciliarstreifen ist bis auf einen schmalen Strich über dem Auge durch gelbbraun ersetzt; die dunkle Querbänderung der Oberseite ist schmäler; die schwarzbraune Zeichnung auf den Flügeldecken und den Skapularen ist gröber; Unterseite weniger lebhaft rotbraun (düsterer), auf den Seiten und auf der Brust mit mehr oder minder deutlichem graubräunlichem Anflug, Uebergang zwischen dem Braun des Bauches und dem Grau der Brust daher weniger scharf; auf den Weichen meist einige Federn mit unterbrochenen schwarzbraunen Terminalsäumen. Die schwarzbraune Färbung der Kehle ist stark reduziert, ähnlich wie *mitunter* bei *A. b. bartelsi.* Flügel (angepresst) ♂ 158, ♀ (5 St.) 1 × 145, 2 × 144, 2 × 143 mm (also grösser als *javanica* und *bartelsi*).

Die neue Form bildet einen Uebergang zu dem so ganz verschieden gefärbten *A. b. orientalis* aus Ost-Java, bei dem ebenfalls die Flecken am Hinterkopf fehlen und bei dem die Seiten des Bauches stark schwarzbraun gezeichnet sind.

Untersucht 8 Ex. (1 ♂ 1 ♂ inad. 4 ♀♀ in coll. Bartels, 1 ♀ in coll. P. J. Bouma, 1 ♀ im Zool. Museum Buitenzorg, alle vom G. Lawoe (auf der Grenze zwischen Mittel- und Ost-Java), ca 1500 - 2000 m ü.M., 12.VI.1933 und 15.-28. VI. 1936, M. Bartels & H. J. V. Sody und M Bartels & P. J. Bouma leg.

T y u s in coll. Bartels, ♀ ad., G. Lawoe ca 2000 m, 24.VI.1936, M. B. & P. J. B. leg.

Anmerkung. Durch die Güte des Herrn M. A. Lieftinck vom Buitenzorger Museum konnte ich die typische Serie von *A. b. bartelsi* Siebers (10 Ex. vom G. Tjereme, leg. J. J. Menden) mit 12 (6 ♂♂ 6 ♀♀) *A. b. javanica* in unserer Sammlung vergleichen. Es zeigte sich dabei, dass die durch Siebers angegebenen Unterschiede nicht allgemeingültig sind. Der Oberkopf ist nur bei *einem javanica*-Männchen deutlich *rötlich*braun, sonst stimmt die Färbung des Ober-

kopfes in beiden Serien jedoch ziemlich genau überein. Die Stirnflecken sind nur bei 2 *javanica* weniger scharf abgesetzt, bei den übrigen 10 Ex. heben sie sich ebenso scharf ab wie bei *bartelsi*. Die Querbänderung der Oberseite ist bei dieser Form *meist* in der Tat breiter als bei *javanica;* 3 von unseren *javanica*-Weibchen stimmen in dieser Hinsicht jedoch genau mit den Tjereme-Vögeln überein. Das Rotbraun der Skapularen und der Unterseite ist zwar meist, aber *nicht immer*, dunkler als bei *javanica*. Grenze zwischen dem Grau der Brust und Rotbraun des Bauches, wie bei *javanica*, scharf.

A NEW SUBSPECIES OF RATTUS BARTELSII (JENTINK) FROM CENTRAL JAVA.

By

M. BARTELS, Jr.

(Soekaboemi, Java).

Rattus bartelsii obscuratus subsp. n.

Type: — Adult male (skin and skull), coll. M. BARTELS Jr. no. Sl 37, G. Slamet, Central Java, ca 2500 m, Aug. 26, 1933, M. BARTELS Jr. & P. J. BOUMA leg.

Diagnosis: — Differs from *R. b. bartelsii* from G. Pangrango-Gede, W. Java, by the following characters: both body and skull *smaller;* hindfoot and ear *distinctly shorter;* hindfeet (skin and hairs) more obscured (less white) than in the typical race; tail not so purely white beneath, the white, especially on the basal part of the tail and sometimes over the whole of its length, darkened by a more or less distinct greyish violet tinge; fur on head and back as a rule *darker* (less yellowish); abdomen as in *bartelsii typicus* but never showing a (slight) suffusion of yellowish brown (which sometimes occurs in the latter form); frequently a distinct yellowish brown collar (which seems never to be exhibited by the typical race); line of demarcation between the colours of the upper and lower parts as a rule sharper.

Measurements: See next page.

(The measurements of 3 adult males of *R. b. bartelsii* from G. Pangrango in my collection (measurements taken in the same way) are: head and body 136-159 (average 146.5); tail 131.5-139 (134.5); ear 22.5-24 (23.16); hindfoot 32-33.5 (32.83); skull, greatest length 36.8-38.3 (37.4); basal length 30.6-32.5 (31.43); zygom. breadth 15.6-16.3 (15.93); median length nasals 14.4-15.4 (14.96); greatest breadth comb. nasals 3.6-3.9 (3.73); palat. foram. 6.2-6.3 (6.23); diastema 10.1-10.5 (10.26); upper mol. row 5.2-5.4 (5.3) mm. Two adult females measure: head and body 135-145 (140); tail 135.5-138 (136.75); ear 23.5; hindfoot 32-33.5 (32.75); skull, greatest length 36.5-37.2 (36.85); basal length 31.4-31.7 (31.55); zygom. breadth 15.9-16.6 (16.25); median length nasals 14.3-14.6 (14.45); greatest breadth comb. nasals 3.8-4.3 (4.05); palat. foram. 6.2-6.3 (6.25); diastema 10.2-10.3 (10.25); upper mol. row 5.3 mm).

Specimens examined: — 26 (ad., subad. and juv.), all from the type locality, W. slopes of G. Slamet, ca 1500-2500 m. (For comparison I disposed of 26 specimens (ad., subad. and juv.) of *R. b. bartelsii* from the type locality: S.W. slopes of G. Pangrango, ca 1500-2000 m).

Measurements: [1])

No. Coll. M. BARTELS Jr.	Sex	Head and body	Tail	Ear	Hindfoot	Skull								Remarks
						Greatest length	Basal length	Zygomatic breadth	Median length nasals	Greatest breadth combined nasals	Palatal foramina	Diastema	Upper molar row	
Sl 2	♂	133.5	134.5	20.5	30.5	34.4	28.8	15.5	13.1	3.6	5.7	9.5	5.1	Test. 20 mm
„ 8	„	144.5	111+x	21	31.5	35.8	30.6	16.5	13.9	3.5	6.1	9.9	5	Test. large, 23 mm Teeth worn
„ 12	„	130.5	133.5	20	31	34	28.7	15.5	12.4	3	5.6	9.2	5.1	Test. mod. devel.
„ 13	„	—	128	20.5	29.5	34.2	28.3	15.6	13	3.3	5.4	9.3	5	Test. large T. w.
„ 14	„	137	126	19	30	—	—	15.3	13.1	3.3	5.6	9.3	5.2	Test. large T. w.
„ 37	„	140	136	20.5	30.5	34.8	29.9	15.6	13.4	3.7	6.1	9.8	5.2	Test. 22.5 mm T. sl. w. *Type*
„ 4	♀	136	127	21	29	—	—	15.6	12.9	3.4	5.8	9.6	4.9	Mamm. much devel. T. w.
„ 22	„	117	120.5	20	29.5	32.9	27.2	14.9	12.2	3.1	5.7	8.6	5.2	Mamm. much devel.
„ 25	„	122	126.5	19.5	30	—	—	14.9	12.3	3.3	5.6	8.9	5.1	„ „ „
„ 27	„	120.5	128.5	20	28.5	33.6	27.9	15.2	12.4	3.3	5.6	9.1	5.1	„ „ „
„ 34	„	113	130	19.5	28	—	27.6	14.6	12.3	3.1	5.6	9.1	4.9	„ „ „
„ 53	„	121.5	133	19.5	29.5	32.9	27.7	15.1	12.3	3.1	5.6	9	5.2	Mamm. mod. devel.

[1]) In this particular case the head-and-body-length was taken from the tip of the nose to the anus. As in the adult males, owing to the development of the testes, the anus has moved a good deal backwards, the h.-a.-b.-l. of the latter obtained by employing this method becomes larger, relatively, than that of the females, whereas in the case of the tails just the reverse comes true. The figures thus obtained consequently must be considered separately for each of the two sexes. (To avoid this drawback I now use the hind-border of the thigh-muscles at the base of the tail as a boundary-point. See for my opinion about this subject: H. J. V. SODY, Nat. Tijdschr. Ned. Ind., 94, p. 177).

All of my specimens were measured after having been preserved in spirit.

HERPETOLOGISCHE NOTIZEN XVIII.

Ueber die systematische Stellung der Art Trimeresurus gramineus (Shaw) von den Sunda-Inseln.

Von

Dr. FELIX KOPSTEIN

(Magelang, Java).

Die Studie, welche C. H. POPE in „American Museum Novitates" (No. 620; 1933) [1]) über *Trimeresurus gramineus* veröffentlichte, veranlasste mich, das gramineus-Material des Zoologischen Museums in Buitenzorg und mein eigenes Studienmaterial nach den von POPE aufgestellten Gesichtspunkten zu revidieren.

Für den Malaiischen Archipel werden 2 Arten genannt, *Trimeresurus gramineus* und *Tr. albolabris*. Als Verbreitungsgebiet gibt POPE für diese 2 Arten jenen Teil Süd-Ost-Asiens an, welcher sich von Burma bis in den Malaiischen Archipel erstreckt. *Tr. albolabris* soll nach Osten Timor erreichen, während *Trimeresurus gramineus* im Malaiischen Archipel bloss auf Sumatra und Borneo vorkommen soll. Auf Sumatra kommen also nach POPE beide Arten vor, auf Java und den Kleinen Sunda-Inseln aber bloss *Tr. albolabris*.

Dem von POPE gegebenen Schlüssel zufolge gilt die Verschmelzung des Nasale mit dem 1. Supralabiale als Hauptmerkmal für *Tr. albalabris*. Auf Grund *dieses* Merkmales könnte tatsächlich das gesamte Material von Java und den Kleinen Sunda-Inseln zu *albolabris* gestellt werden. Von *Trimeresurus gramineus* wäre darnach bloss ein einziges Stück aus Sumatra vorhanden.

Diese ungleiche Verteilung des Materials gestattet bloss die Schlangen von Java und den Kleinen Sunda-Inseln kritisch zu untersuchen. Dabei fanden wir, dass sie wohl in mehreren Punkten mit *Tr. albolabris* übereinstimmen, in anderen Merkmalen aber auch der Beschreibung von *Tr. gramineus* entsprechen, so dass *hier* eine scharfe Trennung in 2 Arten nicht durchführbar ist.

Eine definitive Entscheidung der Frage, soweit sie die Sunda-Inseln betrifft, wird aber erst getroffen werden können, bis auch von Sumatra und Borneo genügend Studienmaterial zur Verfügung steht.

In der vorliegenden Arbeit werden die folgenden *Trimeresurus* Exemplare besprochen:

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[1]) „A study of the green pit-vipers of southeastern Asia and Malaysia, commonly identified as *Trimeresurus gramineus* (SHAW), with description of a new species from peninsular India".

Sumatra	1	Exemplar(e)
West-Java	46	„
Mittel-Java	21	„
Ost-Java	1	„
Madoera	2	„
Lombok	2	„
Soembawa	9	„
Soemba	8	„
Flores	4	„
Timor	13	„
ingesamt	107	Stück

Wenn wir von dem 1 sumatranischen Stück absehen, so zeigen die restlichen 106 die folgenden Merkmale:

Das *Rostrale* ist etwas breiter als hoch, an seiner Basis ungefähr doppelt so breit als an der Spitze. Hierin stimmen sie mit *Tr. albolabris* überein. Bei *Tr. gramineus* ist das Rostrale an der Basis beinahe 3 mal so breit als an der Spitze und viel breiter als hoch.

Die *Internasalia* sind in 14 Fällen durch ein kleines Schild von einander getrennt. Die Grösse dieses Schildes ist veränderlich; sie variiert vom Umfang einer kleinen Schuppe bis zur Hälfte eines Internasale. Die Trennung der beiden Internasalia ist nach Pope eines der Artmerkmale von *Tr. gramineus*, kommt hier aber in 13% der Fälle bei *Tr. albolabris* vor.

Das *Nasale* ist in allen Fällen mit dem 1. Supralabiale verschmolzen. Beinahe alle Individuen lassen aber die ursprüngliche Entstehung aus 2 Schildern an den Resten einer Naht erkennen, welche das Nasolabiale vorne und hinten einkerbt. Manchmal ist die Verschmelzung auch noch durch einen scharfen Bug angedeutet, welchen das Schild an jener Stelle zeigt, wo die Verschmelzung stattgefunden hat. Keine der 106 untersuchten Schlangen zeigt aber eine so deutliche Trennung der beiden Schilder, wie das sumatranische Stück.

Pope gibt für seine *Tr. gramineus* an, dass die obere Partie des 2. *Supralabiale* durch 2 Schilder vom Nasale getrennt ist. Von meinem Material besitzen 29 (= 28 %) 1 oder 2 kleine Schilder zwischen dem Nasale und dem oberen Teil des 2. Supralabiale. Sie erweisen sich wohl deutlich als abgetrennte Teile, entweder des Nasale oder des Supralabiale, ergeben aber dennoch dadurch einen Übergang zwischen *Tr. gramineus* und *Tr. albolabris*. Ausserdem fehlen gerade bei dem einzigen aus Sumatra vorhandenen Exemplar, das sonst der Beschreibung von *Tr. gramineus* entspricht, diese beiden Schilder. Das Nasale grenzt stets an das 2. Supralabiale. Dieses bildet den Vorderrand der zwischen dem Auge und den Nasenlöchern gelegenen Grube.

Die Zahl der zwischen den *Supraocularen* gelegenen Schilder beträgt bei dem sumatranischen Exemplar (*Tr. gramineus*) 8 - 10, bei den anderen 8 - 13, meist 10 - 12. Da Pope für seine *Tr. gramineus* 13 - 14 Schilder angibt, weicht also mein Sumatra-Exemplar auch hierin von der gegebenen Beschreibung ab.

Das *3. Supralabiale* ist stets am grössten.

Die Zahl der Schilder zwischen dem *Suboculare* und den Supralabialen gibt Pope für *Tr. albolabris* mit 1 an, für *Tr. gramineus* aber mit 2. Mein Material stimmt hierin mit keiner von beiden Arten überein. Meist liegt zwischen dem 4. Supralabiale und dem Suboculare 1 Schild, zwischen dem 5. Supralabiale und dem Suboculare aber 2. Manchmal finden wir oberhalb des 4. Supralabiale 2 und oberhalb des 5. drei Schilder.

Die *Gularschilder* sind in deutlichen Paaren angeordnet. Diese Anordnung ist bei den javanischen Exemplaren regelmässiger als bei jenen von den Kleinen Sunda-Inseln.

Während die erwachsenen Exemplare dorsal stets deutlich gekielte Schuppen besitzen und bloss die äussersten 1 - 2 Schuppenreihen glatt sind, erscheinen bei den meisten ganz jungen Schlangen alle Schuppen ungekielt. Mit zunehmendem Alter treten stets deutlicher werdende Kiele auf, welche mit wachsender Körperlänge eine zunehmende Zahl von Reihen umfassen. Dasselbe gilt für die Schuppen des Kopfes. Wir können diese bei allen jungen Exemplaren als glatt bezeichnen, bei alten Tieren aber als stumpf gekielt.

Mit einer einzigen Ausnahme besitzen alle Exemplare auf der Rumpfmitte 21 Schuppenreihen; auch dort, wo *albolabris* nach Pope 19 Schuppenreihen zählen müsste.

Mein Material zeigt 148 - 171 Ventralia in folgendem Verhältniss:

148 ...... 1×	159 ...... 8×	166 ...... 8×
153 ...... 2×	160 ...... 7×	167 ...... 4×
154 ...... 2×	161 ...... 11×	168 ...... 2×
155 ...... 1×	162 ...... 8×	170 ...... 2×
156 ...... 1×	163 ...... 14×	171 ...... 1×
157 ...... 5×	164 ...... 9×	
158 ...... 4×	165 ...... 6×	

Die meist vorkommenden Zahlen liegen zwischen 159 und 166; vornehmlich finden wir 163 Ventralia.

Die Subcaudalia zeigen die folgende Reihe:

53 ...... 1×	61 ...... 10×	71 ...... 8×
55 ...... 3×	62 ...... 5×	72 ...... 3×
56 ...... 5×	63 ...... 6×	74 ...... 3×
57 ...... 12×	64 ...... 2×	75 ...... 2×
58 ...... 6×	68 ...... 2×	76 ...... 3×
59 ...... 12×	69 ...... 2×	77 ...... 1×
60 ...... 6×	70 ...... 1×	79 ...... 2×

Die Färbung und Zeichnung gibt keinerlei Gelegenheit, die Sunda-*Trimeresurus* dieser oder jener Art zuzustellen. Die Unterseite, welche bei *Tr. albolabris* gelblich-weiss, bei *Tr. gramineus* aber grün sein soll, ist bei nahezu allen Exemplaren grünlich. Die lateralen Schuppenreihen sind beinahe immer einfärbig grün, wenn auch meist heller als die dorsalen.

Der weisse oder gelbliche Marginalstreifen hat keine systematische Bedeutung. Meist fehlt er gänzlich. Von gleichgrossen und gleichgeschlechtlichen Exemplaren vom selben Fundort zeigt das eine diesen Streifen wohl, das andere dagegen nicht.

Die weissliche Färbung der Supralabialia mit deutlicher Abgrenzung gegen das Grün der Kopfoberseite ist bei den Schlangen von den Sunda-Inseln ein Ausdruck des Jugendkleides, Beinahe alle jungen *Tr. gramineus* zeigen dieses Merkmal, welches mit zunehmendem Alter verschwindet. Schon bei halbwüchsigen Exemplaren sind die Supralabialia grünlich und ist die Trennungslinie verschwommen.

Zusammenfassung.

Wenn wir die morphologischen Merkmale dieser 106 Trimeresurus von Java und den Kleinen Sunda-Inseln zusammenfassen, so sehen wir, dass sie sowohl *albolabris-*, als auch *gramineus*-Kennzeichen aufweisen. Von allen Unterscheidungsmerkmalen, welche POPE anführt, ist *bloss das mit dem 1. Supralabiale verwachsene Nasale konstant.*

Bei dem Sumatra-Exemplar, bei welchem das Nasale und das 1. Supralabiale völlig getrennt sind und welches daher als *Trimeresurus gramineus* aufzufassen ist, fehlen die beiden Schilder, welche zwischen dem Nasale und dem oberen Teil des 2. Supralabiale vorhanden sein sollten. Auch liegen zwischen den Supraocularen bloss 8 - 10 Schilder.

Wenn wir die Verschmelzung des Nasale mit dem 1. Supralabiale als Artkriterium acceptieren, zo gehört das gesamte Material von Java und den Kleinen Sunda-Inseln zu *Tr. albolabris.* Es weicht aber in einer Reihe von belangreichen Momenten von der Artbeschreibung ab. Die Internasalia sind 14 mal (= 13 %) durch ein kleines Schild voneinander getrennt. 29 mal (= 28 %) liegen zwischen dem Nasale und dem oberen Teil des 2. Supralabiale 1 oder 2 kleine Schildchen. Das Suboculare ist von den Supralabialen durch 1 resp. 2, manchmal sogar durch 3 Schilder getrennt. Die Färbung der Unterseite ist meist grün. Ein heller Marginalstreifen ist bloss bei einem kleinen Prozentsatz vorhanden. Die abgegrenzte weisse Färbung der Supralabialia zeigen bloss junge Tiere. Sie verschwindet bereits bei halbwüchsigen Exemplaren.

Die Untersuchung dieses Materials lehrt, dass die grünen *Trimeresurus* von Java und den Kleinen Sunda-Inseln artlich nicht von *Trimeresurus gramineus* getrennt werden können. Mit einer gewissen Reserve will ich sie vorläufig als subspec. auffassen, *Trimeresurus gramineus albolabris,* wobei als *einziges konstantes Merkmal die Verschmelzung des Nasale mit dem 1. Supralabiale* gilt. Aber auch diese Auffassung erfordert die Voraussetzung, dass sich bei einem grossen Material von Sumatra und Borneo die Trennung des Nasale vom 1. Supralabiale als konstant erweisen wird.

Trimeresurus gramineus gramineus (SHAW) SUMATRA

Fundort (Höhe in m über dem Meeresspiegel)	Sq.	V.	Sc.	Praeocularia	Postocularia r.	Postocularia l.	Supralabialia (inkl. dem Nasale) r.	Supralabialia (inkl. dem Nasale) l.	Anzahl Schilder zwischen den Supraocularen	Anzahl Schilder zwischen dem Suboculare und dem 4. Supralabiale	Anzahl Schilder zwischen dem Suboculare und dem 5. Supralabiale	Internasalia miteinander in Kontakt	das Suboculare mit dem 3. Supralabiale in Kontakt	Anzahl Schilder zwischen dem oberen Teil des 2. Supralabiale und dem Nasale r.	Anzahl Schilder zwischen dem oberen Teil des 2. Supralabiale und dem Nasale l.	Anzahl Schuppen zwischen den Internasalen und den Supraocularen r.	Anzahl Schuppen zwischen den Internasalen und den Supraocularen l.
Alahan Pandjang: ± 1450 m (S. W. K)	19-19-15	148 + 1	61/61 + 1	2	2	2	10	10	8-10	1	1	—	—	0	0	3	3

Trimeresurus gramineus albolabris GRAY WESTJAVA

Fundort (Höhe in m über dem Meeresspiegel)	Sq.	V.	Sc.	Praeocularia	Postocularia r.	Postocularia l.	Supralabialia (inkl. dem Nasale) r.	Supralabialia (inkl. dem Nasale) l.	Anzahl Schilder zwischen den Supraocularen	Anzahl Schilder zwischen dem Suboculare und dem 4. Supralabiale	Anzahl Schilder zwischen dem Suboculare und dem 5. Supralabiale	Internasalia miteinander in Kontakt	das Suboculare mit dem 3. Supralabiale in Kontakt	Anzahl Schilder zwischen dem oberen Teil des 2. Supralabiale und dem Nasale r.	Anzahl Schilder zwischen dem oberen Teil des 2. Supralabiale und dem Nasale l.	Anzahl Schuppen zwischen den Internasalen und den Supraocularen r.	Anzahl Schuppen zwischen den Internasalen und den Supraocularen l.
Nandjoeng Djaja, Tjibatoe ± 700 m	21-21-15	161 + 1	75/75 + 1	2	2	2	11	10	9-10	1	1	+	+	0	1	4	4
„ „	23-21-15	159 + 1	57/57 + 1	2	2	2	11	11	12-13	1	2	—	+	0	0	4	4
Indramajoe; Nordküste	21-21-15	165 + 1	71/71 + 1	2	2	2	12	10	10	1	2	+	+	0	0	4	3
„ „	21-21-15	170 + 1	59/59 + 1	2	2	3	11	11	11-12	1	2	+	+	1	0	4	4
„ „	21-21-15	167 + 1	71/71 + 1	2	2	2	9	10	9-10	1	2	+	+	0	0	3	4
„ „	21-21-15	168 + 1	68/68 + 1	2	2	2	12	11	8- 9	1	2	+	+	1	1	4	3
Pengalengan; ± 1800 m	21-21-15	155 + 1	59/59 + 1	2	2	2	11	11	11	1	2	+	+	0	1	5	6
„ „	21-21-15	154 + 1	57/57 + 1	2	2	2	11	11	11	1	2	+	+	2	0	6	6
„ „	21-21-15	158 + 1	62/62 + 1	2	2	2	10	11	11	1	2	+	+	0	0	5	5
„ „	23-21-15	157 + 1	72/72 + 1	2	2	2	11	11	11	1	2	+	+	0	0	4	5
„ „	23-21-15	158 + 1	60/60 + 1	2	2	2	12	11	11	2	2	+	+	2	1	6	6
„ „	23-21-15	157 + 1	75/75 + 1	2	2	2	11	12	11	2	2	+	+	1	1	5	5
„ „	23-21-15	159 + 1	76/76 + 1	2	2	2	10	11	10	2	2	+	+	1	1	4	5
„ „	23-21-15	154 + 1	71/71 + 1	2	2	2	10	11	10	2	2	—	+	0	0	4	4
„ „	23-21-15	153 + 1	57/57 + 1	2	2	2	10	11	11	1	2	+	+	0	0	4	6

Trimeresurus gramineus albolabris GRAY WESTJAVA

Fundort (Höhe in m über dem Meeresspiegel)	Sq.	V.	Sc.	Praeocularia	Postocularia		Supralabialia (inkl. dem Nasale)		Anzahl Schilder zwischen den Supraocularen	Anzahl Schilder zwischen dem Suboculare und dem		Internasalia miteinander in Kontakt
					r.	l.	r.	l.		4.	5.	
										Supralabiale		
Weitere Umgebung	21-21-15	165+1	58/58+1	2	2	3	11	11	13	2	2	+
von Bandoeng	23-21-15	164+1	63/63+1	2	2	2	11	11	14	2	2	+
„	21-21-15	166+1	58/58+1	2	2	2	12	12	12	2	2	+
„	— 21-15	163+1	59/59+1	2	2	2	11	11	12	2	2	+
„	— 21-15	163+1	59/59+1	2	2	2	12	13	13-14	2	2	—
„	23-21-15	162+1	59/59+1	2	2	2	11	11	11	2	2	+
„	- 21-15	163+1	59/59+1	2	2	2	11	11	13	2	2	+
„	25-21-15	165+1	59/59+1	2	2	2	11	9	13	2	2	+
„	23-21-15	164+1	62/62+1	2	2	2	11	12	12-13	2	3	+
„	25-21-15	166+1	63/63+1	2	2	2	11	?	11-12	2	2	+
„	25-21-15	166+1	61/61+1	2	3	2	10	11	11-12	2	2	+
„	25-21-15	164+1	61/61+1	2	2	2	11	11	11	2	3	+
„	27-21-15	162+1	61/61+1	2	2	?	11	11	13	2	3	+
„	21-21-15	170+1	58/58+1	2	3	3	12	12	12	1	2	—
„	25-21-15	165+1	63/63+1	2	2	2	10	10	11	1	2	+
„	23-21-15	161+1	64/64+1	2	2	3	10	12	11-12	2	3	+
„	23-21-15	166+1	62/62+1	2	2	2	12	12	13	1	2	+
„	— 21-15	164+1	58/58+1	2	2	2	12	11	12	1	2	+
„	25-21-15	163+1	64/64+1	2	2	2	10	10	12-13	2	3	+
„	23-21-15	163+1	61/61+1	2	2	2	11	11	11-13	2	3	+
„	25-21-15	162+1	63/63+1	2	3	3	11	11	14	2	2	+
„	23-21-15	159+1	59/59+1	2	3	3	11	12	11-12	2	3	+
„	23-21-15	161+1	59/59+1	2	2	?	11	12	13	2	2	+
„	23-21-15	167+1	59/59+1	2	2	?	11	11	12	2	3	+
„	23-21-15	165+1	60/60+1	2	?	2	?	?	11-13	2	2	+
„	25-21-15	162+1	61/61+1	2	2	2	12	12	12	2	3	+
„	23-21-15	165+1	60/60+1	2	2	2	11	11	11	1	2	+
„	21-21-15	164+1	63/63+1	2	3	3	12	12	13	2	3	+
„	21-21-15	164+1	70/70+1	2	2	2	11	11	10-11	2	2	+
Indramajoe	21-21-15	166+1	61/61+1	2	2	2	10	11	11-12	2	2	+
„	21-21-15	171+1	61/61+1	2	2	2	12	12	11-12	1	2	+

Bei diesen 31 Exemplaren steht das Suboculare 15 mal mit den 3. Supralabiale in Kontakt. Zwischen dem oberen Teil des 2. Supralabiale und dem Nasale liegt 7 mal 1 kleines Schild und 2 mal 2 Schilder.

Fundort (Höhe in m über dem Meeresspiegel)	Sq.	V.	Sc.	Praeocularia	Postocularia r.	Postocularia l.	Supralabialia (inkl. dem Nasale) r.	Supralabialia (inkl. dem Nasale) l.	Anzahl Schilder zwischen den Supraocularen	Anzahl Schilder zwischen dem Suboculare und dem 4. Supralabiale	Anzahl Schilder zwischen dem Suboculare und dem 5. Supralabiale	Internasalia miteinander in Kontakt	das Suboculare mit dem 3. Supralabiale in Kontakt	Anzahl Schilder zwischen dem oberen Teil des 2. Supralabiale und dem Nasale r.	Anzahl Schilder zwischen dem oberen Teil des 2. Supralabiale und dem Nasale l.	Anzahl Schuppen zwischen den Internasalen und den Supraocularen r.	Anzahl Schuppen zwischen den Internasalen und den Supraocularen l.
Sapoeran, Wonosobo, ± 500 m	25-21-15	157 + 1	59/59 + 1	2	2	2	13	13	12	2	2	–	+	0	0	5	5
„ „	25-21-15	162 + 1	60/60 + 1	2	2	1	11	11	11	1	2	+	+	0	0	5	5
„ „	23-21-15	158 + 1	Spitze abgebrocken	2	3	2	12	12	12	2	2	–	+	0	1	5	4
„ „	25-21-15	162 + 1	62/62 + 1	2	2	2	12	12	11	1	2	+	–	0	0	4	5
„ „	23-21-15	161 + 1	72/72 + 1	2	2	2	12	10	9-11	1	2	+	+	0	1	4	3
Selomojo, Wonosobo, ± 500 m	21-21-15	163 + 1	57/57 + 1	2	3	2	11	11	10-11	1	2	–	+	0	0	5	4
„ „	23-21-15	163 + 1	79/79 + 1	2	2	2	11	11	9	2	2	+	+	0	0	4	3
„ „	21-21-15	161 + 1	74/74 + 1	2	2	2	10	9	9	1	2	+	+	0	0	3	3
„ „	23-21-17	160 + 1	63/63 + 1	2	2	2	11	11	11	1	?	–	+	1	0	5	5
„ „	23-21-15	161 + 1	76/76 + 1	2	2	2	11	11	10	1	2	+	+	1	1	4	4
„ „	23-21-15	161 + 1	76/76 + 1	2	2	2	11	11	10-11	1	1	+	+	0	1	4	4
„ „	23-21-15	159 + 1	57/57 + 1	2	2	2	11	11	11-13	2	2	–	–	1	1	5	5
„ „	21-21-15	156 + 1	61/61 + 1	2	2	2	11	11	11	2	2	+	+	1	0	5	4
„ „	23-21-15	159 + 1	77/77 + 1	2	2	2	11	10	9-10	1	2	+	+	1	2	5	3
„ „	21-21-15	159 + 1	60/60 + 1	2	2	2	11	12	12	2	2	+	+	0	1	5	5
„ „	21-21-15	163 + 1	79/79 + 1	2	2	2	11	10	9-10	1	2	+	+	1	1	4	3
„ „	21-21-15	160 + 1	62/62 + 1	2	2	2	11	11	12	2	2	–	+	2	1	5	5
„ „	23-21-15	158 + 1	57/57 + 1	2	2	2	11	12	12	?	?	+	+	0	0	4	4
„ „	23-21-15	163 + 1	74/74 + 1	2	2	2	11	11	8-10	1	2	+	+	0	0	3	3
Tjandiroto, Bedjen, ± 500 m	23-21-15	159 + 1	71/71 + 1	2	2	2	11	12	8-10	1	2	+	+	0	0	3	4
„ „	23-21-15	157 + 1	71/71 + 1	2	3	2	10	10	9-10	1	2	+	+	0	0	4	4
Ostjava																	
Nongkodjadjar, ± 1200 m	21-19-15	161 + 1	74/74 + 1	2	2	2	10	10	9-10	1	1	+	+	0	0	3	3
Madoera	—	—	—	2	2	2	11	10	10-11	1	2	+	+	0	0	0	0
„	—	—	—	2	2	2	11	11	10	2	3	+	+	0	0	0	0

Fundort (Höhe in m über dem Meeresspiegel)	Sq.	V.	Sc.	Pracocularia	Postocularia		Supralabialia (inkl. dem Nasale)		Anzahl Schilder zwischen den Supraocularen	Anzahl Schilder zwischen dem Suboculare und dem		Internasalia miteinander in Kontakt	das Suboculare mit dem 3. Supralabiale in Kontakt.	Anzahl Schilder zwischen dem oberen Teil des 2. Supralabiale und dem Nasale	
					r.	l.	r.	l.		4. Supralabiale	5. Supralabiale			r.	l.
Lombok	21-21-15	167 + 1	61/61 + 1	—	—	—	—	—	—	—	—	+	—	—	—
„	21-21-15	166 + 1	57/57 + 1	2	2	2	10	10	11	2	2	—	—	0	0
Soembawa	21-21-15	162 + 1	55/55 + 1	2	2	2	11	10	11	2	2	+	+	1	1
„	—	—	—	2	2	2	10	10	10	1	2	+	+	0	0
„	21-21-15	161 + 1	71/71 + 1	2	2	2	11	11	12	1	1	+	+	0	0
„	21-21-15	159 + 1	71/71 + 1	2	2	2	10	11	9-10	1	2	+	+	0	0
„	21-21-15	168 + 1	56/56 + 1		—	—	10	11	12-13	1	2	+	+	0	0
„	21-21-15	161 + 1	60/60 + 1	2	2	2	11	11	9-10	1	2	+	+	0	0
„	21-21 —		—	2	2	2	11	10	10	1	2	+	+	0	0
„	21-21-15	160 + 1	53/53 + 1	2	2	2	10	11	10-11	1	2	—	+	0	0
„	23-21-15	164 + 1	55/55 + 1	2	2	2	11	11	10	1	2	+	+	0	0
Soemba	23-21-15	161 + 1	69/69 + 1	2	2	2	10	10	9-10	1	2	+	+	0	0
„	21-21-15	160 + 1	69/69 + 1	2	2	2	10	10	11	2.1	3,2	+	+	0	0
„	23-21-15	166 + 2	58/58 + 1	2	2	2	10	10	12	1	2	+	+	0	0
„	— 21-15	163 + 1	57/57 + 1	2	2	2	9	11	11	?	?	—	—	0	0
„	21-21-15	164 + 1	56/56 + 1	2	2	2	10	10	12	1	2	+	+	0	0
„	23-21-15	163 + 1	56/56 + 1	2	2	2	10	10	12-13	?	?	+	+	0	0
„	21-21-15	160 + 1	72/72 + 1	2	2	2	9	10	11	1	2	+	+	0	0
„	21-21 —	—	—	2	2	2	9	10	10-12	1	2	—	+	0	0

Fundort (Höhe in m über dem Meeresspiegel)	Sq.	V.	Sc.	Poracocularia	Postocularia		Supralabialia (inkl. dem Nasale)		Anzahl Schilder zwischen den Supraocularen	Anzahl Schilder zwischen dem Suboculare und dem		Internasalia miteinander in Kontakt	das Suboculare mit dem 3. Supralabiale in Kontakt	Anzahl Schilder zwischen dem oberen Teil des 2. Supralabiale und dem Nasale	
										4.	5.				
					r.	l.	r.	l.		Supralabiale				r.	l.
Flores	23-21-15	—	57/57 + 1	2	2	2	—	11	12	1	2	+	+	0	0
„	23-21-15	157 + 1	—	2	2	2	10	10	9-11	1	1	+	+	0	0
„	23-21-15	160 + 1	71/71 + 1	2	2	2	10	10	10	1	2	+	+	0	0
„	23-21-15	160 + 1	57/57 + 1	2	2	2	10	9	9-11	1	2	+	+	0	0
Timor	25-21-15	163 + 1	57/57 + 1	2	2	2	10	10	9-10	1,2	2	+	+	0	0
„	—	—	—	2	2	2	10	11	10-12	1	2	+	+	0	0
„	—	—	—	2	2	2	10	11	9-10	1	2	+	+	0	0
„	—	—	—	2	2	2	10	10	9-10	1	2	+	+	0	0
„	—	—	—	2	2	2	11	11	10	1	2	+	+	0	0
„	—	—	—	2	2	2	10	10	9	1	1	+	+	0	0
„	—	—	—	2	2	2	10	10	12	1	2	+	+	0	0
„	23-21-15	162 + 1	55/55 + 1	2	2	2	10	10	11-12	1	2	+	+	0	0
„	23-21-15	164 + 1	58/58 + 1	2	2	2	10	10	10-11	1	2	+	+	0	0
„	21-21-15	167 + 1	59/59 + 1	2	2	2	10	11	10-11	1	2	+	+	0	0
„	21-21-15	166 + 1	57/57 + 1	2	2	2	11	11	9-12	1	2	+	+	0	0
„	21-21-15	163 + 1	56/56 + 1	2	2	2	10	10	10	1	2	+	+	0	0
„	23-21-15	163 + 1	56/56 + 1	2	2	2	10	10	11-12	1	2	+	+	0	0

Merkwürdigerweise liegt bei diesem 36 Tr. gramineus albolabris von den Kleinen Sunda-Inseln bloss 1 mal ein kleines Schild zwischen demoberen Teil des 2. Supralabiale und dem Nasale, während dies bei dem javanischen Material wesentlich häufiger gesehen wird.

EINIGE BEMERKUNGEN UEBER DIE DIFFERENZIERUNG DES RASSENKREISES ALCEDO EURYZONA TEMMINCK.

Von

M. BARTELS jr.

(Soekaboemi, Java).

M a t e r i a l: J a v a: 1 ♂ coll. Raffles Mus.-Singapore, 10 ♂♂ 10 ♀♀ coll. Bartels; S u m a t r a: 1 ♂ coll. Mus. Buitenzorg, 2 ♂♂ coll. Raffles Mus.; B o r n e o: 1 ♀ coll. Mus. Buitenzorg, 1 ♂ ?inad. 1 ♀ juv. coll. Raffles Mus.; M a l a k k a: 1 ♂ 1 ♂ juv. 1 ♀ ?med. coll. Raffles Mus.

Alcedo euryzona wurde nach einem aus Java herkünftigen Männchen beschrieben.

Schon vor vielen Jahren machte mich mein Vater gesprächsweise darauf aufmerksam, dass ein Weibchen dieses Eisvogels von Borneo, das er damals im Zool. Museum zu Buitenzorg zu untersuchen Gelegenheit gehabt hatte, g a n z a n d e r s a u s s e h e als die Weibchen auf Java. Auf Java besitzt das (unterseits rotbraune) Weibchen nämlich genau so wie das (unterseits weissliche) Männchen e i n b r e i t e s b l a u e s B r u s t b a n d, während es im ganzen übrigen Verbreitungsgebiet (ausgenommen vielleicht Sumatra) k e i n Brustband aufweist. Es ist wohl die grosse Seltenheit von javanischen Exemplaren dieses Eisvogels in den Museumssammlungen der Grund, dass diese Tatsache bis jetzt noch immer unerkannt blieb: die ♀♀ der gesamten Art wurden von mehreren Autoren als unterseits einfarbig rostbraun, o h n e Brustband, beschrieben! (siehe z.B. bei Sharpe [1]), Robinson [2]), Kuroda [3]). Schlegel [4]) dagegen glaubte, dass das ♀ ganz wie das ♂ gefärbt sei, und hielt die unterseits ganz braunen Exemplare für Junge beiderlei Geschlechts.

Durch das freundliche Entgegenkommen von Mr. F. N. Chasen, Direktor vom Raffles Mus. zu Singapore und Herrn M. A. Lieftinck von Buitenzorger Mus. war ich in der Lage das oben aufgeführte Material der Art vergleichen zu können, wofür den beiden genannten Herren bestens gedankt sei.

Das Resultat möchte ich hier kurz mitteilen:

Die Form *nigricans* Blyth (Tenasserim und Malayische Halbinsel) die Robinson (*l.c.*) noch als zweifelhaft bezeichnet hat, während sie Chasen in seiner „Handlist of Malaysian Birds" (1935) offenbar ebenfalls noch nicht ganz zweifelsfrei erachtet [5]), unterscheidet sich von der typischen Rasse (Java) nicht

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1) Cat. Birds Brit. Mus., XVII, p. 155 (1892).
2) The Birds of the Malay Peninsula, II, p. 47 (1928).
3) The Birds of the Island of Java, II, p. 407 (1937).
4) De Vogels van Nederlandsch Indië, De IJsvogels, Pl. 1, fig. 1 u. 2 (ohne Jahreszahl).
5) Der Autor erwähnt dort nämlich auf S. 100 als einziger Unterschied: "Males from the Malay Peninsula seem to have the underparts more washed with rufous than those from Java and Borneo".

nur sehr auffallend durch das Fehlen des Brustbandes beim Weibchen, sondern auch dadurch, dass die blauen Federn des Brustbandes beim Männchen grosse weisse Zentren besitzen. Beim javanischen Vogel sind diese weissen Flecken nämlich viel schmäler, sie sind sogar bei der Mehrzahl der Federn nur noch als feine weisse Schaftlinie vorhanden. Ferner scheint die blaue Farbe des Brustbandes bei *nigricans* etwas weniger intensiv zu sein und überdies ist die Form anscheinend kleiner. Die Masse der 3 untersuchten Stücke sind: Flügel ♂ ad. 85 ♂ juv. 88 ♀ ?med. 86, während 10 ♂♂ und ebensoviele ♀♀ von Java in unserer Sammlung 87 - 90,5 (durchschn. 88,95) und 86 - 89 (durchschn. 87,05 + x) mm Flügellänge haben. Schnabel: ♂ ad. 41,5 (die Schnäbel des ♂ juv. und des ♀ ?med. messen nur 32 und 36 mm) gegen 40 - 45 (durchschn. 42,35) und 40 - 43 (durchscn. 41,40) mm bei *euryzona*.

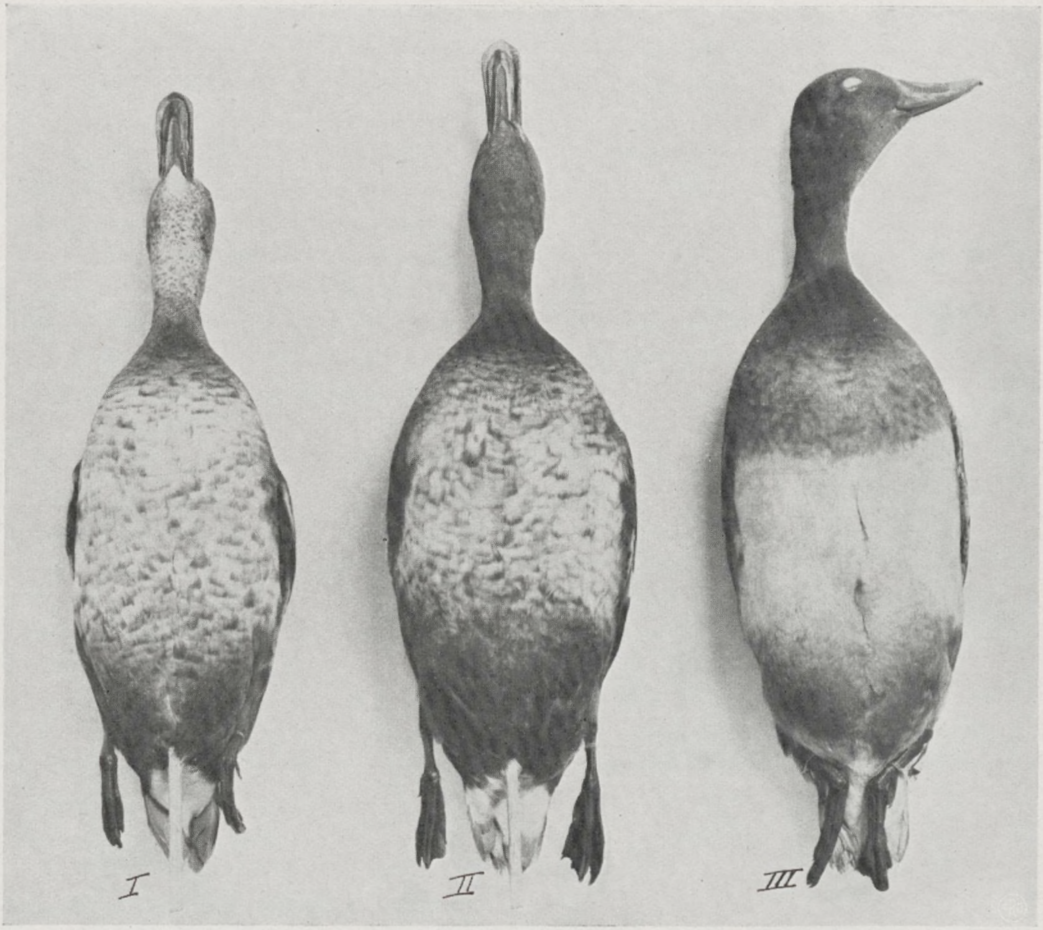
Der durch CHASEN angeführte Unterschied in der Färbung der Unterseite bei den Männchen (siehe Fussnote) fand ich an dem verglichenen Material nicht durchweg bestätigt: unter den javanischen Männchen unserer Sammlung befinden sich mehrere Exemplare, deren Unterseite (namentlich auf den Weichen) ebenfalls deutlich gelbbraun überlaufen ist.

Von den 3 sumatranischen Vögeln (alles ♂♂) sind 2 (aus Serdang, N.-O.-Sum.) hinsichtlich der Ausdehnung der weissen Farbe auf den Federn des Brustbandes intermediär (in verschiedenem Grade) zwischen *euryzona* und *nigricans*, das dritte Stück (aus Lahat, O.-Sum.) stimmt in diesem Merkmal ziemlich mit *nigricans* überein. Die Masse der 3 Exemplare sind: Flügel 85, 85, — Schnabel 43, 41, 42 mm. In der Flügellänge stimmen sie also vermutlich mit *nigricans* überein, während der Schnabel ebenso kräftig erscheint wie beim javanischen Vogel.

Ueber ein Weibchen von Sumatra, welches sich im Leidener Mus. befindet, schreibt mir Herr Dr. JUNGE folgendes: „Dit ex. heeft een kraag, die alleen mediaan onderbroken (von mir gesperrt-B.) is". Dieses Stück würde also, was das Brustband anbelangt, etwa die Mitte halten zwischen *euryzona* und *nigricans!* Der sumatranische Vogel stellt demnacht wahrscheinlich eine Uebergangsform dar, welche zwischen den beiden genannten Rassen vermitteln würde.

Ueber das Borneo-Material ist wenig zu sagen. Möglicherweise wird sich bei Vergleich von Serien herausstellen, dass die Männchen von Borneo unterseits reiner weiss sind und hellere Unterflügeldecken haben als *nigricans*. Im übrigen scheinen sie, namentlich was die Färbung der Federn des Brustbandes anbetrifft, gut mit den Männchen der Malakka-Form übereinzustimmen. Das ♀ ad. zeigt eine etwas dunklere Kehle und dunklere Unterflügeldecken als das ♀ ?med. von *nigricans* aus Malakka. Die Masse der Borneo-Vögel sind: Flügel ♂ ?inad. 82 ♀ ad. 81 ♀ juv. 82 (also anscheinend kleiner als *nigricans*) Schnabel 37, 40, 32 mm.

Es ist nicht unwahrscheinlich, dass sich auch für Borneo eine eigene Rasse wird feststellen lassen, wenn einmal gute Serien zur Verfügung stehen werden.



I & II *Nyroca australis ledeboeri*, I ♀ (Btzg Mus. No. 7793), II ♂ (Btzg Mus. No. 7791);
III *Nyroca australis australis* ♂.

EINE NEUE ENTE AUS JAVA

Von

M. BARTELS jr. und P. F. FRANCK
(Soekaboemi u. Buitenzorg, Java).

In der populär-wissenschaftlichen Zeitschrift „De Tropische Natuur", Jg. 26, 1937, p. 112, hat FRANCK über eine für Java neue Ente berichtet die, wie sich erst in den letzten Jahren herausgestellt hat, auf zwei Gebirgsseen in Ost-Java in kleiner Anzahl als Brutvogel lebt. Ein altes Männchen dieser Ente wurde 1937 von Herrn A. J. M. LEDEBOER dem Zoologischen Museum in Buitenzorg geschenkt. Danach konnte die Art als *Nyroca australis* EYTON bestimmt werden. Da es jedoch an Vergleichsmaterial aus Australien mangelte, liess sich die Subspezies vorläufig nicht feststellen.

Vom Australian Museum in Sydney erhielt das Buitenzorger Museum nun kürzlich den Balg einer topotypischen *N. australis* (aus N.S. Wales) zum Vergleich übersandt. Wir haben das Stück, ebenfalls ein ♂ ad., mit unserem Exemplar verglichen und feststellen können, dass letzteres deutlich abweicht. Der javanische Vogel sei deshalb als neue Subspezies gekennzeichnet:

Nyroca australis lebeboeri subsp. nov.

Die neue Rasse ist von der Nominatform durch folgende Merkmale unterschieden: Kopf und Hals weniger violettrötlich. Am Flügelbug weniger weiss. Kropf nur ganz vorn am Hals braun, sonst weiss, wie der Bauch (bei *australis* ist die ganze Kropfgegend violettrotbräunlich gefärbt). Das Weiss der Unterseite nicht scharf gegen das Braun des Kropfes abgesetzt, wie bei dem australischen Vogel, sondern allmählich darin übergehend. Die Unterseite ist nicht einheitlich weiss, sondern überall schimmert die dunkle Basis der Federn zwischen dem Weiss hervor, wodurch die Unterseite mehr oder minder braun-weiss gebändert erscheint. Die weissen Säume der Bauchfedern sind schmäler und das Braun der Basis dieser Federn ist dunkler. Das Braun des Unterbauches ist ebenfalls dunkler. Nacktteile: An dem einige Tage in Spiritus vorpräparierten Exemplar war der Schnabel von der Basis ab bis etwa 10 mm über die Nasenöffnungen tief dunkelbraun (van Dijckbraun). Das etwas im Winkel nach hinten und vorne laufende Querband weisslichblaugrau, nicht scharf abgesetzt. Der vordere Teil des Schnabels ebenfalls dunkelbraun, das erhöhte Dreieck der Schnabelspitze schwarz. Der Lauf war blaugrau, die Schwimmhäute schwarzbraun.

Masse: (zwischen Klammern sind die Masse des Vergleichsexemplars beigefügt): Flgl. 223 (224); Schw. 58 (61); Schnab. 47 (47); Lauf 35 (37) mm.

Typus: ♂ ad.,[1]) coll. Mus. Buitenzorg Nr. 7791, Gebirgssee Toendjoeng, Hiang-Plateau, Ost-Java, ca 2000 m, 3.VI.1937, J. M. TEN CATE leg.

Herr LEDEBOER machte dem Museum inzwischen 2 weitere Exemplare zum Geschenk. Es sind ein noch nicht ganz erwachsenes ♂ und ♀. Beide stimmen in der allgemeinen Gefiederfärbung gut mit dem Typus überein. Nur hat das ♂ weniger, das ♀ dagegen mehr Weiss auf der Unterseite als jener; ausserdem sind bei dem ♀ die Kehlfedern weiss gesäumt, wodurch die Kehle ein weiss-braun geflecktes Aussehen erhält.

Wir haben diese neue Subspezies zu Ehren des freundlichen Gebers benannt, zugleich in Anerkennung dessen von so schönem Erfolg gekrönten naturschutzerischen Bestrebungen auf dem Hiang-Plateau.

N.B. Die *N. australis* von Celebes und den papuanischen Inseln wären noch näher auf die Subspezies hin zu prüfen.

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[1]) Die Testes waren stark entwickelt. Sie massen: 29 × 18 × 10 mm.

ON A COLLECTION OF BIRDS FROM ENGGANO

by

Dr. G. C. A. JUNGE

(Rijksmuseum van Natuurlijke Historie, Leiden).

From the end of May till the beginning of July 1937 my cousin Dr. W. J. LÜTJEHARMS stayed on the island Enggano (west off Sumatra) for botanical collecting purposes. He was accompanied by Dr. J. K. DE JONG as zoologist and some native taxidermists from the Buitenzorg Museum. The birds were collected by Dr. J. K. DE JONG and by SAÄN, who brought together 149 skins belonging to 29 species. I am much indebted to Dr. K. W. DAMMERMAN, director of the Buitenzorg Museum, who placed this collection in my hands and allowed the Leiden Museum to keep a part of the material, the rest to be returned to Buitenzorg.

Though this collection does not contain anything new, it is important enough for a full report, as after SALVADORI's paper in 1892 (Ann. Mus. Civ. Stor. Nat. Genova, vol. 32) only a few scattered notes have been published about the birds of this island. The collection contains 5 species which have not yet been collected on Enggano.

Remarkable for the races of this island seems to be that they are as large or even larger than the races from Simalur with the exception of *Halcyon chloris azela,* which is smaller than the race *chloroptera* occurring on the other West Sumatran islands.

For a good map of the island with the names of the localities where has been collected I refer to Treubia, vol. 16, 1937, p. 48. My best thanks are due to Dr. O. DE BEAUX, Genoa; Dr. H. FRIEDMANN, Washington and Mr. N. B. KINNEAR, London for their kindness in sending me material for comparison.

Treron curvirostra hypothapsina OBERH.

Treron curvirostra hypothapsina OBERHOLSER, SMITHS. Misc. Coll., vol. 60, no. 7, 1912, p. 3 (Enggano island).

Meok: 2 ♂♂, 1 ♀ (nos. 84, 85, 120).
Boeah-Boeah: 3 ♀♀ (nos. 69, 72, 73).
Kaja-Apoe: 1 ♂ (no. 138).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
85	♂	19-6-1936	150	82	17	26
120	♂	26-6-1936	145	83	17	24
138	♂	3-7-1936	152	89	16.5	25

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
69	♀	11-6-1936	147	84	15	22
72	♀	12-6-1936	151	88	16	23
73	♀	12-6-1936	144	82	16.5	24
84	♀	19-6-1936	138	82	15	23

Enggano birds are larger than Sumatran birds and as large as Simalur birds, but between these two there are some differences in colour. The upper tail-coverts in Enggano birds are darker green (less yellow), the underparts are more yellowish green, in ♂♂ as well in ♀♀, though greener in the ♂♂ than in the only ♂ from Pulu Babi I have before me. In the ♂♂ some other differences exist, the posterior parts of the flanks, the thighs and vent are green mixed with yellow, while in Simalur birds these parts are mixed with white. Moreover in Enggano birds the under tail-coverts are slightly paler brown and the grey on the head extends a trifle further backwards.

Unfortunately I have not seen material from Nias or the Mentawei islands.

In all ♂♂ the gonads were enlarged, they were small in the ♀♀.

Treron vernans subspec.

Kiojoh: 1 ♂, 1 ♀ (nos. 61, 62).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
62	♂	9-6-1936	151	98	15	19
61	♀	9-6-1936	144	—	15	21

The primaries of the ♀ are in a very worn state, some are moulting. Compared with birds from Simalur, Nias and one from North Pagi, the ♂ does not show much difference in colour, the abdomen is slightly less yellow and more green. It may be, however, that this is individual variation. The ♀ lacks the greyish hue on the back which is found in the Simalur and Nias specimens before me, which agrees, however, with the worn state of the plumage.

The wing measurement of the ♂ is larger than I found for Nias birds, in which the variation range for 5 ♂♂ was 144 - 147 mm (TEMMINCKIA, vol. 1, 1936, p. 6). This corresponds with the variation range of birds from the Mentawei islands (Ibis, 1926, p. 274) as reported by CHASEN and BODEN KLOSS (♂♂ 142 - 148 mm).

The only difference between the latter and birds from South Sumatra (*griseicapilla*) seems to be that Sumatran birds have smaller minimum measurements and may be smaller on an average. The ♂ from Enggano exceeds the maximum measurements of ♂♂ from Nias as far as I found and comes nearer to *miza* from Simalur. The ♀ agrees in wing measurement with ♀♀ from Nias, but the wing is in a worn state. Having too few specimens from Enggano I must leave the question to what race they belong unsettled. More material is needed to prove if they are really larger than Nias birds and this being the case, if there are constant differences with Simalur birds.

The gonads were large in the ♂, small in the ♀.

Ducula aenea oenothorax (SALVAD.)

Carpophaga oenothorax SALVADORI, Ann. Mus. Civ. Stor. Nat. Genova, vol. 32, 1892, p. 139 (Enggano island).

Boeah-Boeah: 3 ♂♂, 1 ♀ (nos. 23, 25, 28, 29).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
23	♂	28-5-1936	244	144	21	34
28	♂	30-5-1936	245	148	21	33
29	♂	30-5-1936	249	149	23	32
25	♀	30-5-1936	235	130	22	31

An easily recognizable race by the greenish blue instead of dark brown under tail-coverts. These birds seem also to be slightly larger than birds from the other West Sumatran islands, especially the tail is longer. The skins before me are exceedingly fat, which makes it impossible to use the colours for comparison.

Eye: red-brown. Bill: black with leaden blue rhamphotheca and line along the edge of the lower mandible. Feet: red.

Gonads large in all ♂♂, the ovarium was rather small.

Myristicivora bicolor bicolor (SCOP.).

Columba bicolor SCOPOLI, Del Flor. et Fauna Insubr., 2, 1786, p. 94 (New Guinea).

Kiojoh: 2 ♂♂, 1 ♀ (nos. 42, 44, 49).
Meok: 2 ♂♂ (nos. 83, 144).
Kaja-Apoe: 1 ♂ (no. 127).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
42	♂	4-6-1936	233	117	22	28
49	♂	5-6-1936	223	119	21	29
83	♂	19-6-1936	226	121	22	27
127	♂	30-6-1936	211	112	21	27
144	♂	8-7-1936	222	113	22	29
44	♀	4-6-1936	225	115	22	28

In nearly all the ♂♂ the gonads were moderately enlarged, large only in no. 42. Ovarium small.

Macropygia cinnamomea SALVAD.

Macropygia cinnamomea SALVADORI, Ann. Mus. Civ. Stor. Nat. Genova, vol. 32, 1892, p. 140 (Enggano island).

Meok: 1 ♂, 2 ♀♀, 1 — (nos. 4, 87, 88, 121).
Kaja-Apoe: 1 ♂ (no. 139).
Boeah-Boeah: 1 ♀ (no. 27).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
87	♂	20-6-1936	195	177	20	27
139	♂	3-7-1936	200	178	20	25
27	♀	30-5-1936	192	—	—	23
88	♀	20-6-1936	201	173	20	22
121	♀	26-6-1936	193	173	20	22
4	—	23-5-1936	194	181	19	21

I list these birds as a species and not as a race of *M. phasianella,* it is quite unlike any of the races of *phasianella* I saw. Besides the much larger wing and stronger bill, there is also much difference in colour. The adult birds differ in being of a much paler brownish colour, especially on the upperside with no trace of a purplish gloss. The throat-feathers possess black lateral margins. The birds which I consider to be immature have the head, neck and throat darker. The upperparts are much darker, since they are washed with black and in one specimen (no. 87) the feathers possess a subterminal black band. The two central pair of tail-feathers are brownish black instead of brown.

The eyes in the ♂ ad., blue with yellow ring, in the ♀ ad., brown with pale ring. Bill and feet in the ♂ ad. red, the ♀ ad. bill blue-grey, feet black.

In the immature birds eyes reddish brown, bill dark grey till blue, feet dark blue.

Chalcophaps indica indica (*L.*)

Columba indica LINNÉ, Syst. Nat., 10th ed., 1758, p. 164 (East Indies).

Dakoaha: 1 ♂ imm., 1 ♀ imm. (nos. 93, 110).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
110	♂ imm.	24-6-1936	137	71	18	24
93	♀ imm.	21-6-1936	136	79	17	25

Rallina fasciatus (RAFFL.)

Rallus fasciatus RAFFLES, Trans. Linn. Soc. London, vol. 13, 1822, p. 328 (Bencoolen).

Boeah-Boeah: 1 ♂, 2 ♀♀, 1 ♀ juv. (nos. 24, 36, 50, 66).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
24	♂	30-5-1936	123	44	22	41
36	♀	2-6-1936	128	48	20	40
66	♀	10-6-1936	124	53	20	41
50	♀ juv.	6-6-1936	120	51	20	44

Amaurornis phoenicurus javanicus (HORSF.)

Gallinula javanica HORSFIELD, Trans. Linn. Soc., London, 13, pt. 1, 1821, p. 196 (Java).

Meok: 1 ♂ (no. 89).

Kaja-Apoe: 1 ♀ (no. 129).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
89	♂	20-6-1936	149	58	37	53
129	♀	1-7-1936	137	53	33	48

These birds are unseparable from a series of *javanicus* from different localities. For measurements of specimens from various localities see Temminckia, vol. 1, 1936, p. 5. This species was not yet collected on Enggano.

Testis moderately developed, ovarium rather small.

Ardea purpurea manillensis MEYEN

Ardea purpurea var. *manillensis* MEYEN, Acta Acad. Leop. Carol., 16, Suppl., 1834, p. 102 (Manila, Philippines).

Meok: 1 ♀ (no. 5).
Dakoaha: 1 ♂ imm. (no. 117).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
117	♂ imm.	25-6-1936	351	116	135	134
5	♀	24-5-1936	350	117	121	130

Demigretta sacra sacra (GM.)

Ardea sacra GMELIN, Syst. Nat., 1 pt. 2, 1789, p. 640 (Tahiti).

Kiojoh: 3 ♂♂ (nos. 42, 77, 78).
Kaja-Apoe: 1 ♂ (no. 126).
Poelau Doewa: 1 ♀ (no. 128).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
42	♂	3-6-1936	274	90	77	72
77	♂	14-6-1936	269	95	81	76
78	♂	14-6-1936	257	86	82	75
126	♂	30-6-1936	275	91	82	72
128	♀	30-6-1936	251	80	75	70

The ♀ is an immature bird in the dark phase with brownish lesser upper wing-coverts and primary-coverts. Besides this specimen also no. 42 is in the dark phase, the other ones are in the white phase.

Gonads small till moderately enlarged.

Ixobrychus cinnamomeus cinnamomeus (GMEL.)

Ardea cinnamomea GMELIN, Syst. Nat., 1, pt. 2, 1789, p. 643 (China).

Dakoaha: 1 ♂ (no. 97).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
97	♂	22-6-1936	141	43	50	45

First record of this species for Enggano, it has never been reported from any of the islands west off the Sumatran coast.

Otus sunia enganensis RILEY

Otus umbra enganensis RILEY, Proc. Biol. Soc. Washington, vol. 40, 1927, p. 93 (Enggano island)

Dakoaha: 2 ♂♂, 3 ♀♀ (nos. 103, 107, 111, 112, 116).

No.	Sex	Date	Wing	Tail	Culmen from cere	Tarsus
107	♂	23-6-1936	160	78	14.5	27
111	♂	24-6-1936	163	74	16	27
103	♀	22-6-1936	166	82	15	29
112	♀	24-6-1936	163	75	16	28
116	♀	25-6-1936	163	78	16	28

Thanks to the kindness of Mr. N. B. KINNEAR, London, I could compare these skins with three specimens of *Otus sunia sunia* from British India and four of *Otus sunia malayanus* from Malacca. Of the latter race the Leiden Museum possesses one specimen from Deli, Sumatra, collected by HAGEN on 31-1-1887 (cf. Dr B. HAGEN, Die Pflanzen. und Thierwelt von Deli auf der Ostküste Sumatra's. Tijdschr. Kon. Ned. Aardr. Genootschap, 2e ser., deel 7, 1890, pp. 1—240). In this paper HAGEN lists this bird sub nomen *Scops sunia* (p. 131). CHASEN in his Handlist of Malaysian Birds (1936, p. 85) could not confirm the locality Sumatra given by ROBINSON in his Birds of the Malay Peninsula (I, 1927, p. 81), but probably ROBINSON based his opinion on this specimen, which I consider to be a migrant.

I agree with TICEHURST (Ibis 1923, p. 241), who treats *sunia* and its allies as a distinct species. The wing formula is different from *Otus scops* and its allies and it seems more natural, therefore, to keep the *sunia* group separate and not to lump it with *Otus scops*.

In wing formula the Enggano birds agree with *sunia*, they are larger, darker and heavier built than *sunia* or *malayanus*. The darkest bird (no. 103) is nearly uniform russet brown below with many black vermiculations, only the under tail-coverts possess small white bars. The upperparts are very dark blackish brown. The palest bird has whitish spots on the throat-feathers, whitish bars on the lower abdomen and much white on the under tail-coverts. This specimen is very near a specimen of *malayanus* from Kuroo (Brit. Mus.) in colour. Breast and abdomen are more uniform brown in the Enggano bird. Feathers in front of the eye white in *enganensis*, brownish in *malayanus*. The upperparts of both birds correspond nearly completely. I have not seen *umbra* from Simalur, but certainly *enganensis* can be treated as an ally of *sunia* and in all probability *umbra* too. This is interesting since *sunia* seems not to breed in Sumatra, Java and Borneo and it reminds of the case of *Lyncornis macrotis jacobsoni* from Simalur, in which the same is found.

My measurements of the Enggano birds are a good deal larger than those given for the type by RILEY, but the variation range is mostly large in these small owls.

Eye: yellow; upper mandible: bluish; under mandible: dirty yellow; feet: bluish grey. Gonads in the ♀♀ small, in the ♂♂ moderately enlarged.

Nos. 103 and 112 show wingmoult.

Psittacula longicauda modesta (FRASER)

Palaeornis modestus FRASER, Proc. Zool. Soc., 1845, p. 16 (no locality).

Meok: 4 ♂♂, 1 ♂ imm., 2 ♀♀ (nos. 3, 7, 16, 17, 18, 19, 119).
Kaja-Apoe: 1 ♂ (no. 141).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
7	♂	24-5-1936	192	248	29	19
16	♂	25-5-1936	206	256	30	20
17	♂	25-5-1936	205	282	30	20
119	♂	26-6-1936	202	233	29	21
141	♂	3-7-1936	196	233	29	20
19	♂ imm.	25-5-1936	200	131	—	21
3	♀	23-5-1936	194	140	28	21
18	♀	25-5-1936	195	139	30	19

This race is very well described by SALVADORI in the Catalogue of the Birds in the British Museum, vol. 20, pp. 471—472. They are remarkable larger than *longicauda* and differ also in colour from the nominal race.

The males are rather uniform, only 2 (nos. 17, 119) show more reddish on the upper breast and also the mantle can vary slightly in colour, in nos. 7 and 119 being paler and more bluish than in the other specimens.

The immature ♂ differs from the ♀♀ by the slightly greener tinged head and in the colour of the bill. In the ♀♀ the bill is black, in the young and the adult ♂♂ the upper mandible is red, the lower mandible blackish.

The colour of the eyes in all birds is reported as white, the colour of the feet as blue-grey.

The gonads in the ♂♂ nearly all moderately enlarged, some were large, rather small in the ♀♀.

Loriculus galgulus (L.)

Psittacus Galgulus LINNÉ, Syst. Nat., ed. 10, 1, 1758, p. 103 (India, i.e. Malacca).

Meok: 1 ♂, 1 ♀ imm. (nos. 6, 82).
Dakoaha: 1 ♂ (no. 113).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
6	♂	24-5-1936	83	32	11	11
113	♂	24-6-1936	84	32	10	10.5
82	♀ imm.	18-6-1936	86	34	11	11

I am convinced that the race *dolichopterus*, which OBERHOLSER founded on one specimen (♀) from Enggano (cf. RILEY, Proc. U.S. Nat. Mus., vol. 75, no. 4. 1929, p. 13), cannot be upheld. OBERHOLSER described it (Smiths. Misc. Coll., vol. 60, no. 7, 1912, p. 5) as being decidedly larger than birds from Sumatra and Borneo and being darker. Compared with 6 ♂♂, 6 ♀♀ from Sumatra, 11 ♂♂, 5 ♀♀ from Borneo, 2 ♂♂ from Banka, 1 ♂ from Nias I cannot detect any difference in colour, nor is there any difference in measurements.

			Wing	Culmen
Sumatra	♂♂	(6)	82-86	10-12 mm
	♀♀	(6)	80-88	10-12 „
Banka	♂♂	(2)	85	11-12 „
Borneo	♂♂	(11)	78-84	10-12 „
	♀♀	(5)	82-84	10-11 „
Nias	♂		82	10 „
Enggano	♂♂	(2)	83-84	10-11 „
	♀		86	11 „

The ♀ immature differs from the adult birds by being more green, less yellow below and in having the red of the rump duller. The forehead shows a bluish tinge. The colour of the bill in this specimen is dull brown with a blue edge along the uppermandible.

The testis is reported as small in no 6, large in no. 113.

Alcedo meninting subspec.

Kaja-Apoe: 1 ♂ (no. 142).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
142	♂	4-7-1936	63	26.5	36	8

An new record for Enggano again.

The small wing measurement of this single bird makes it difficult to decide to what race the kingfishers from Enggano belong. The difference between *meninting* from Java and *verrauxii* from Borneo, Sumatra and Malay Peninsula in my opinion is mainly a difference in measurements as I pointed out before (Temminckia, vol. 1, 1936, p. 34). This bird fits in the variation range of both, so more material is needed to give a definite opinion, especially as Simalur birds are unseparable from Javan birds.

This specimen is rather dark violet blue coloured, but specimens of this colour are found as well in Borneo, Java and Simalur.

The only specimen from the race *proxima* I have seen is a bird from North Pagi which is slightly greener blue on the upperside than all our other birds, and therefore agrees with RICHMOND's original description of this race (Proc. Biol. Soc. Washington, vol. 25, 1912, p. 104).

Halcyon chloris azela (OBERH.)

Sauropatis chloris azela OBERHOLSER, Proc. U.S. Nat. Mus., vol. 55, 1919, p. 377 (Enggano island).

Meok: 1 ♂ (no. 2).
Kiojoh: 1 ♀ (no. 47).
Boeah-Boeah: 1 ♀ (no. 67).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
2	♂	23-5-1936	103	66	40	14
67	♀	11-5-1936	101	65	38	14
47	♀	5-6-1936	99	60	37	15

Differs from *chloroptera* from the other West Sumatran islands and from *cyanescens* from Java and Sumatra by smaller size. The colour of the auriculars is darker than in a series of *cyanescens* and agrees with *chloroptera*, the breadth of the black and white nuchal bands, however, is nearer to *cyanescens*. The ♂ is purer greenish blue above than the 2 ♀♀, in which the upperparts are strongly washed with blackish green.

Gonads are reported as being small.

No. 47 has the breast-feathers edged with small blackish bars.

Hemiprocne longipennis perlonga (RICHM.)

Macropteryx perlonga RICHMOND, Proc. U. S. Nat. Mus., vol. 26, 1903, p. 502 (Simalur island).

Meok: 1 ♂, 1 ♀ (nos. 86, 123).
Dakoaha: 2 ♂♂, 1 ♀ (nos. 95, 96, 104).
Kiojoh: 1 ♀ (no. 58).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
95	♂	21-6-1936	180	103	7	8
104	♂	23-6-1936	176	108	6	9
123	♂	27-6-1936	175	117	6	9
58	♀	7-6-1936	177	109	7	8
86	♀	19-6-1936	181	94	7	8
96	♀	21-6-1936	180	115	6.5	9

This species is already reported from this island by SALVADORI (1892). He mentioned that these birds were larger than specimens from Malacca and Borneo. This is perfectly right, in size these birds agree with Simalur birds (cf. Temminckia, vol. 2, 1937, p. 198) and I cannot see constant differences in colour either. The extension of the white on the abdomen is variable in this series, in no. 123 the abdomen is rather greyish, the same is found, however, in a Simalur specimen. The birds of Simalur are perhaps slightly more brownish on throat and breast, but this certainly is more a question of wear than of geographical

variation [1]). Three specimens from the Batu islands, which Dr. H. FRIEDMANN, Washington was so kind to send me, in my opinion are not separable from *perlonga* too, and OBERHOLSER's race *thoa* from these islands therefore I consider a synonym of *perlonga*. The wing measurements of these birds are ♂♂ (2) 177—179, ♀ (1) 176 mm. *Ocyptera* from Nias I have not seen.

Cacomantis variolosus sepulcralis (S. MÜLL.)

Cuculus sepulcralis S. MÜLLER, Verh. Nat. Gesch. Land- en Volkenkunde, 1839—1844, p. 177 (Java and Sumatra).

Meok: 1 ♂ (no. 124).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
124	♂	27-6-1936	115	128	16	18

A ♂ in change.

Hirundo tahitica javanica SPARRM.

Hirundo javanica SPARRMAN, Mus. Carlson, vol. 2, 1789, plate 100 (Java).

Meok: 1 ♂ (no. 13).
Dakoaha: 2 ♂♂, 1 ♀ (nos. 94, 109, 115).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
13	♂	24-5-1936	103	48	9	9
109	♂	24-6-1936	105	50	9	10
115	♂	25-6-1936	105	46	9	10
94	♀	21-6-1936	103	45	8	10.5

In Temminckia vol. 1, 1936, pp. 46 and 47 I discussed already the material in the Leiden Museum. The Enggano birds are not separable from the Javan birds before me and I do not hesitate to list them as *javanica*. These birds were not previously collected on Enggano.

Gerygone fusca sulphurea WALL.

Gerygone sulphurea WALLACE, Proc. Zool. Soc., 1863, p. 490 (Solor).

Meok: 1 ♂ (no. 1).
Kiojoh: 1 ♂ (no. 65).
Boeah-Boeah: 2 ♂♂ (nos. 32, 38).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
1	♂	23-5-1936	52	37	10	16
32	♂	31-5-1936	50	38	10	17
38	♂	2-6-1936	51	35	10	17
65	♂	9-6-1936	52	34	10	17

[1]) Dr. FRIEDMANN, who was so kind to compare some specimens from Engano and Simalur, present in the U. S. National Museum, did not notice any difference in colour in throat and breast between these birds.

I have seen too scanty material from different localities to give a definite opinion and therefore follow MEISE, who in his careful monograph (Novit. Zool., vol. 36, 1931) considers *muscicapa* described by OBERHOLSER from Enggano as a synonym of *sulphurea*. Compared with the birds from Java described by VAN OORT as *G. modiglianii jacobsoni* (Notes Leyden Mus., vol. 31, 1909, pp. 207 - 208) and which MEISE placed also into the synonymy of *G. fusca sulfurea*, the Enggano birds are much more yellow below and greener tinged on the upperparts. The Enggano birds were collected in May, the Java birds, however, in October and November, and the latter have a very worn plumage. The culmen in the Enggano birds is larger than in the Java birds (7.5 - 8.5 mm), but according to MEISE this also is a variable character in this species. The shape of the bill is even variable in the 4 birds from Enggano before me, in no. 1 it is broad at base, in no. 32 the bill is much slenderer (fig. 1).

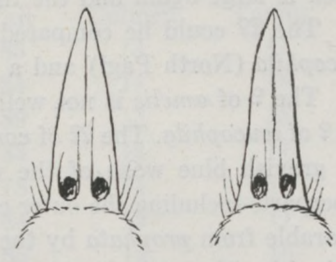

Fig. 1. Shape of the bill (seen from above) in 2 specimens of *G. f. sulfurea* WALL. from Engano (3 ×).

The gonads were small in all specimens.

Hypothymis azurea richmondi OBERH.

Hypothymis azurea richmondi OBERHOLSER, Proc. U. S. Nat. Mus., vol. 39, 1911, p. 607 (Enggano island).

Boeah-Boeah: 3 ♂♂, 3 ♀♀ (nos. 26, 35, 55, 59, 70, 71).
Kaja-Apoe: 1 ♂, 1 ♀ (nos. 136, 137).
Kiojoh: 1 ♀ (no. 64).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
35	♂	1-6-1936	75	70	12	17
59	♂	7-6-1936	74	67.5	11	16
71	♂	12-6-1936	72	69	13	16
137	♂	2-7-1936	74	69	11	17
26	♀	30-5-1936	72	66	11	17.5
55	♀	6-6-1936	73	68	12	17
64	♀	9-6-1936	72	68	—	17.5
70	♀	12-6-1936	70	64	12	16
136	♀	2-7-1936	72	67	12.5	17

I could compare the ♂♂ with a series of *prophata* from Java, Sumatra, Borneo, with 2 ♂♂ from Simalur (*consobrina*) and 1 ♂ from Nias (*amelis*). The latter is nearest to *prophata* by having the same greyish blue abdomen, but is separable by the darker (violet) blue, especially of the head and by the smaller black neckpatch. The ♂♂ from Simalur are paler blue than *prophata* and the black throatband is nearly lacking, the black neckpatches are even slightly smaller than in *amelis* from Nias, the abdomen is more washed with blue than in

amelis and *prophata*. In the Enggano birds the blue of the upperparts is about of the same tone as in *prophata,* but in the latter the blue of the breast is slightly paler, while the abdomen is greyish. In *richmondi* the underparts do not show a difference in tone and the blue colour extends also over the abdomen. The neck-patch is large again and the throatband well developped.

The ♀♀ could be compared with 2 ♂♂ of *consobrina,* 1 ♀ of *amelis,* 1 ♀ of *leucophila* (North Pagi) and a series of *prophata*.

The ♀ of *amelis* is not well separable from the series of *prophata* neither is the ♀ of *leucophila*. The ♀♀ of *consobrina* are characterized by the paler blue head, the greyish blue wash of the underparts and the markedly blue tinge on the upperparts including the outer edges of the tail-feathers. The ♀♀ of *richmondi* are separable from *prophata* by the underparts which are strongly washed with blue again (the blue mixed with a brownish tone, which is lacking in *consobrina*). The upperparts have hardly any blue wash and therefore resemble strongly *prophata*. Also the blue of te head in *richmondi* and *prophata* is about of the same colour. The ♀ of *leucophila* measures 69, of *amelis* 68, of *consobrina* 68 - 73.5 mm, so size differences do not seem of much use for distinguishing the races.

Coracina sumatrensis enganensis (SALVAD.)

Graucalus enganensis SALVADORI, Ann. Mus. Civ. Stor. Nat. Genova, vol. 32, 1892, p. 129 (Enggano island).

Meok: 1 ♂, 1 ♀ (nos. 118, 122).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
122	♂	27-6-1936	162	117	27	25
118	♀	25-6-1936	163	114	26	26

Besides these specimens I saw 1 ♂, 1 ♀ from Enggano, cotypes, kindly sent to me by Dr. O. DE BEAUX, Genua. It is difficult to see difference between these 4 birds from Enggano and a series of *simalurensis*. They seem to be of about the same size. It may be, however, that in series Enggano birds are a trifle darker grey, though it is hardly visible in the birds before me. The only marked difference I can point out is that the abdomen and under tail-coverts in *enganensis* are darker, especially in the ♀♀. In *simalurensis* the abdomen in the ♀♀ is whitish grey, the under tail-coverts white with black bars, in the ♀♀ from *enganensis* the latter are grey with white and indistinct black bars. Also the upper tail-couverts in *simalurensis* seem to be a trifle paler, slightly more whitish coloured. Therefore I do not want to synomymize *simalurensis* with *enganensis,* though a larger material must prove if there are constant differences. I have not seen *crissalis* from the Mentawei islands.

The ♂ is a not fully adult, the underparts are slightly barred, the under wing coverts are barred with black.

Pericrocotus flammeus modiglianii SALVAD.

Pericrocotus modiglianii SALVADORI, Ann. Mus. Civ. Stor. Nat. Genova, vol. 32, 1892, p. 130 (Enggano island).

Meok: 1 ♂, 1 ♀ (nos. 11, 12).
Boeah-Boeah: 3 ♂♂, 2 ♀♀ (nos. 30, 31, 34, 37, 39).
Kaja-Apoe: 1 ♂, 1 ♀ (nos. 133, 135).
Kiojoh: 1 ♀ (no. 63).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
11	♂	24-5-1936	94	83	13	17
30	♂	31-5-1936	93	84	14	16
31	♂	31-5-1936	97	89	13	18
39	♂	3-6-1936	95	83	14	17
133	♂	2-7-1936	91	78	14	16
12	♀	24-5-1936	93	84	13	17
34	♀	1-6-1936	89	85	14	16
37	♀	2-6-1936	93	85	13	16
63	♀	9-6-1936	93	89	14	17
135	♀	2-7-1936	93	92	14	16

In my paper on the birds from Simalur I pointed to the differences between the races *xanthogaster* from Sumatra and *minythomelas* from Simalur. The difference between the ♂♂ is mainly a difference in size, which is also found in the ♀♀. *Modiglianii* from Enggano is averaging larger again.

xanthogaster:	wing in ♂♂	82 - 87 mm
	♀♀	80 - 87 ,,
minythomelas:	♂♂	88 - 94 ,,
	♀♀	87.5 - 90 ,,
modiglianii:	♂♂	91 - 97 ,,
	♀♀	89 - 93 ,,

Between the ♂♂ of *minythomelas* and *modiglianii* I cannot see any difference in colour, seen in a series the red in the ♂♂ in both races is of a slightly more yellowish tinge than it is in *xanthogaster*.

The ♀♀ of *modiglianii* in colour are intermediate between *minythomelas* and *xanthogaster*. The yellow of the underparts in Enggano birds is not so golden yellow coloured as it is in Simalur birds, though the colour is more vivid than in *xanthogaster*. The frontband is as small as in *xanthogaster*, not so broad therefore as in *minythomelas*. The upperparts on the countrary are nearer to those of Simalur birds, perhaps slightly less bluish.

In all ♂♂ the gonads are reported as large, in the ♀♀ as small.

Geokichla leucolaema Salvad.

Geocichla leucolaema Salvadori, Ann. Mus. Civ. Stor. Nat. Gen., vol. 32, 1892, p. 135 (Enggano island).

Meok: 1 ♂, 1 ♀ (nos. 90, 125).
Kaja-Apoe: 2 ♂♂, 1 ♀ (nos. 130, 131, 134).
Boeah-Boeah: 3 ♂♂, 2 ♀♀, 1 ♀ imm. (nos. 34, 35, 56, 74, 75, 81).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
74	♂	13-6-1936	101	70	16	30
75	♂ imm.	13-6-1936	95	62	17	32.5
81	♂	15-6-1936	99	66	17	32
90	♂	20-6-1936	101	64	17	32
130	♂	1-7-1936	105	70	16	32
134	♂	2-7-1936	97	66	16	32.5
34	♀	2-6-1936	102	66	17	32
35	♀ imm.	2-6-1936	97	62	17	33
125	♀	27-6-1936	100	61	16	32.5
131	♀	1-7-1936	97	61.5	15	32.5
56	♀ juv.	7-6-1936	97	62	15	32

I do not follow CHASEN, who in his important Handlist of Malaysian Birds (1935) listed *leucolaema* as a race of *Geokichla interpres*. This goes too far in my opinion.

After SALVADORI's good original description and SEEBOHM's description and plate in his Monograph of the Turdidae, pt. 2, 1898, p. 53, it seems unnecessary to describe this species in detail. The differences between *interpres* and *leucolaema* are large enough to regard *leucolaema* as a separate species. The colour of the head and neck in *leucolaema* is much less bright than in *interpres* and of quite a different tinge. The russet brown upperparts in most specimens of *leucolaema* are not so strongly contrasting with the head as is given in SEEBOHM's plate. The median wingcoverts are only tipped with white, which is nearer to *erytronota* and *dohertyi* than to *interpres,* in which species the white median wing-coverts cause a large white patch on the wing. *Leucolaema* lacks the white on the auriculars and the lores are black and not white as in *interpres.* The olive brown colour of the flanks of *leucolaema* is not found in *interpres.*

In *leucolaema* the first primary is much longer than the primary coverts, in *interpres* this distance is much smaller, in the latter species the third primary is clearly longer than the sixth, in *leucolaema* both are about equal in length, or the third is a trifle longer.

There is a great difference in the juvenile plumage of both species too. The juvenile of *interpres* possesses a reddish brown head, nape and mantle with slightly paler shaftstreaks. The median wing-coverts are white, the lesser and greater wing-coverts are tipped with white. The white tips of the greater wing-coverts are rather large. The breast is whitish brown with dark spots caused by the blackish tips of the feathers. Behind the eye there is a whitish brown patch, the lores are of the same colour.

In the juvenile of *leucolaema* head and upperparts are nearly black, the feathers with small pale brown shaftstreaks. There are some feathers which show already the russet brown tinge of the adult. The median wing-coverts are black with a fan shaped brown terminal spot. The greater wing-coverts are tipped with small brown spots. In the lesser wing-coverts there are only shaftstreaks

of this brown colour. The breast is much blacker than in *interpres* with brown spots. Lores and auriculars are black.

Both immature birds still have the dark heads and there are still many median and greater wing-coverts with brown tips, especially in no. 35. The new feathers are white tipped. The black of the breast still shows brownish spots. The mantle is more reddish brown in no. 75, olive-brown in no. 35. The same variation in the colour of the mantle is also found in the adult birds.

Eye: brown. Bill: black. Feet: ochre, in the juvenile pale yellow.

In all specimens the gonads are reported as being small, in one specimen (♂) only moderately enlarged.

Cisticola juncidis malaya LYNES

Cisticola juncidis malaya LYNES, Ibis, Suppl. number, 1930, p. 92, pl. 2, fig. 2 (Klang, Malacca).

Meok: 1 ♂ (no. 143).

Dakoaha: 2 ♂♂, 4 ♂♂ imm., 1 ♂ (?) imm., 2 ♀♀ (nos. 91, 98, 99, 100, 101, 102, 105, 106, 108).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
91	♂	21-6-1936	49	—	9.5	20
99	♂ (?) imm.	22-6-1936	49	44	9	21
100	♂ imm.	22-6-1936	50	—	—	20
101	♂	22-6-1936	51	38	—	21
102	♂ imm.	22-6-1936	50	43	10	22
105	♂ imm.	23-6-1936	49	44	10	20
108	♂ imm.	24-6-1936	48	40	—	20
143	♂	7-7-1936	50	—	10	20
98	♀	22-6-1936	47	—	10	19
106	♀	23-6-1936	47	—	10	19

According to the yellowish underparts 5 specimens of this series are not fully adult birds, the gonads were small. The adult birds are in a very worn dress, the gonads are reported as moderately enlarged, in no. 143 only as large.

The immature birds in a series of Simalur birds are probably younger as the yellow is more vivid and the upperparts slightly more rufous.

A new record for Enggano.

Zosterops aureiventer salvadorii MEYER and WIGLESWORTH

Zosterops salvadorii A. B. MEYER and WIGLESWORTH, Journ. für Ornithol., 1894, p. 115 (Enggano island).

Meok: 5 ♂♂ (nos. 10, 21, 22, 145, 146).

Kaja-Apoe: 1 ♂ (no. 132).

Boeah-Boeah: 2 ♂♂, 2 ♀♀ (nos. 40, 60, 76, 79).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
10	♂	24-5-1936	59	39	11.5	17
21	♂	25-5-1936	56	40	11	17

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
22	♂	25-5-1936	55	38	11.5	17
60	♂	7-6-1936	57	36	12	18
76	♂	13-6-1936	57	37	12	17
132	♂	1-7-1936	56	38	12	16.5
146	♂	2-7-1936	58	37.5	11	16
145	♂	3-7-1936	57	38	11	16
40	♀	3-6-1936	57	39	12	16
79	♀	14-6-1936	58	39	11.5	17

SALVADORI (1892) described this bird under the name *Zosterops incerta*. MEYER and WIGLESWORTH pointed out that this name was preoccupied and they proposed the new name *Zosterops salvadorii* for the Enggano birds. It seems that no ornithologist saw these birds afterwards. STRESEMANN in his monograph of the genus (Mitt. Zool. Mus. Berlin, vol. 17, 1931) listed *salvadorii* as a race of *Zosterops palpebrosa*. He considered *Z. palpebrosa* and *Z. aureiventer* to be two distinct species and according to the differences he gives between both, we have to consider *salvadorii* as a race of *aureiventer*. *Salvadorii* lacks the yellow stripe above the black lore and the yellow front, it has the upperparts greener than *palpebrosa sumatrana,* also the throat and under tail-coverts are greener yellow, the yellow stripe on the abdomen is less marked. The bill is much stronger in *salvadorii*. Recently CHASEN (Handlist of Malaysian Birds, 1935, pp. 263 - 264) lumps the forms of *aureiventer* with *palpebrosa*. The races of *aureiventer* in Malacca, Sumatra (?) and Borneo are mountain forms, of *palpebrosa* lowland forms. *Salvadorii* in Enggano is a lowland form, but in characters is a race of *aureicenter* (I have not seen true *aureiventer* from Malacca).

I hesitate to follow CHASEN's opinion and think it safest to list the Enggano birds as *Z. aureiventer salvadorii,* notwithstanding the ecological difference, for according to STRESEMANN races of the same species can differ ecologically.

Three skins of *nicobariensis* which I have before me undoubtedly are *palpebrosa*.

Leptocoma jugularis polyclysta (OBERH.)

Cinnyris ornata polyclysta OBERHOLSER, Smiths. Misc. Coll., vol. 60, no. 7, 1912, p. 18 (Enggano island).

Boeah-Boeah: 3 ♂♂, 1 ♀ (nos. 51, 52, 53, 54).
Kiojoh: 1 ♂, 2 ♀♀ (nos. 45, 46, 57).
Dakoaha: 1 ♀ (no. 92).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
51	♂	6-6-1936	55	35	18	14
52	♂	6-6-1936	54	37	18	14
54	♂	6-6-1936	52	33	17	13
57	♂	7-6-1936	55	35	18	15
45	♀	4-6-1936	52	30	18	14

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
46	♀	4-6-1936	51	30	17	15
53	♀	6-6-1936	52	32	17	14
92	♀	21-6-1936	51	30	17.5	13.5

The birds from Enggano are separable from Sumatra, Borneo and Java birds by the darker upper- and underparts as stated by OBERHOLSER. Also by larger size as the following table shows:

			Wing	Culmen	Tail
Enggano	♂♂	(4)	52 - 55	17 - 18	33 - 37 mm
	♀♀	(4)	51 - 52	17 - 18	30 - 32 „
Sumatra	♂♂	(6)	50 - 53	15 - 17	31 - 36 „
	♀♀	(2)	47 - 50	—	32 „
Borneo	♂♂	(5)	50 - 53	17	32 - 33 „
	♀♀	(2)	47 - 49	15 - 16	27.5 - 30 „
Java	♂♂	(6)	51 - 53	16 - 17.5	30 - 35 „
	♀♀	(11)	47 - 51	15 - 17	28 - 33 „

In his Handlist of Malaysian Birds (1935) CHASEN recognizes the race *microleuca* which occurs on Sumatra and Borneo and the race *pectoralis* from Java. In the series before me I cannot see much difference in colour, it may be that Sumatra and Borneo birds are a trifle darker on the upperparts, but the difference is only very slight.

Eye: brown till reddish brown. Bill and feet: black.

Gracula religiosa enganensis SALVAD.

Gracula enganensis SALVADORI, Ann. Mus. Civ. Stor. Nat. Genova, vol. 32, 1892, p. 137 (Enggano island).

Meok: 1 ♂ (no. 14).

Boeah-Boeah: 4 ♂♂ (nos. 33, 36, 68, 80).

Kaja-Apoe: 1 ♀ (no. 140).

No.	Sex	Date	Wing	Tail	Culmen	B. depth at nostr.	Tarsus
14	♂	25-5-1936	175	82	24	13	37
33	♂	31-5-1936	163	80	24	13	34
36	♂	1-6-1936	169	—	27	13	35
68	♂	11-6-1936	172	83	25	14	39
80	♂	14-6-1936	176	86	26	14	37
140	♀	3-7-1936	173	86	25	13	35

These specimens differ from *religiosa religiosa* in having the lappets basally united and the bare patch below the eye smaller and more linear. This series shows again that SALVADORI's original statement that *enganensis* should be smaller is not quite correct. The measurements fit in very well within the variation range of the nominal race. For measurements of *r. religiosa* from different localities see STRESEMANN, Novit. Zool., vol. 19, 1912, p. 314, FINSCH, Notes Leyden Mus., vol. 21, 1899, p. 9, and JUNGE, Temminckia, vol 1, 1936, p. 66.

In nearly all specimens the gonads were small, in one specimen (♂) only moderately enlarged.

Aplonis panayensis enganensis (SALVAD.)

Calornis enganensis SALVADORI, Ann. Mus. Civ. Stor. Nat. Genova, vol. 32, 1892, p. 137 (Enggano island).

Meok: 3 ♂♂, 1 ♂ imm. (nos. 8, 9, 15, 20).

Boeah-Boeah: 1 ♂ (no. 41).

Dakoaha: 1 ♂ (no. 11).

Kiojoh: 1 ♂ (no. 48).

No.	Sex	Date	Wing	Tail	Culmen	Tarsus
9	♂	24-5-1936	115	76	18	25
15	♂	25-5-1936	114	71	17	24
20	♂	25-5-1936	116	76	18	24
41	♂	3-6-1936	110	72	17.5	25
48	♂	5-6-1936	112	71	17	25
114	♂	25-6-1936	115	76	18	26.5
8	♂ imm.	24-5-1936	111	68	17	26

This well distinguishable race is easily recognized by the greater size. It is larger than *altirostris* from Sumatra and Nias and though the culmen is slightly larger it is slenderer than the bill of *altirostris*. I could not see any constant difference in colour between these birds, specimens of *altirostris*, and a series of *strigatus* from Java, Sumatra and Borneo.

The immature bird shows pale edges along the feathers of the breast and abdomen.

In all specimens except the immature bird the gonads were rather large.

APPENDIX

Some time after I finished this report, we received here Natuurkundig Tijdschrift voor Nederlandsch-Indië, vol. XCVIII, 1, March 1938. In this periodical Dr. J. K. DE JONG gives an itinerary of the expedition with many details on the geographical situation of the island and some remarks on the fauna. It is interesting to learn about the absence of any birds of prey and of *Passer montanus*. As the most common birds Dr. DE JONG mentions: *Ducula aenea oenothorax, Myristicivora bicolor bicolor, Chalcophaps indica indica, Ardea purpurea manillensis, Demigretta sacra sacra, Halcyon chloris azela, Psittacula longicauda modesta, Loriculus galgulus, Cacomantis variolosus sepulcralis* and *Zosterops aureiventer salvadorii.*

As an appendix of this paper a list of the collected birds is found as they were identified by HOOGERWERF. Consequently Dr. DE JONG used these names in his paper. Apparently when compiling this list the author could not critically examine the material, and therefore bis identifications differ in many respects from mine. It must be added, however, that it is a preliminary list, which originally was not meant for publication.

UN LEUCOSPIDE (HYM. CHALCIDOIDEA) PARASITE DE CALLIGASTER À JAVA.

Par

CH. FERRIÈRE, Dr. Sc.

(British Museum Nat. Hist., London).

En étudiant les Vespides du genre *Calligaster* à Java, Mr. le Dr. J. v. d. Vecht obtint en 1932 un certain nombre de grands parasites qui éclorent des nids de ces guèpes.

Ces parasites, qui nous furent envoyés, rentrent dans la famille des *Leucospidae,* une grande famille répartie dans toutes les parties du monde et dont tous les représentants, à notre connaissance, se développent dans les nids de Vespides et d'Apides. Cependant le nombre d'espèces dont on connait les hôtes est encore très petit.

Les Leucospides obtenus des Calligaster de Java appartiennent au genre *Epexoclaenoides* Girault. Ce genre se distingue des vrais *Leucospis* F. par le nombre et la petitesse des dents des fémurs postérieurs et par la forme de l'abdomen. Jusqu'ici deux espèces seulement ont été décrites dans ce genre, *E. bicinstus* Girault d'Australie et *E. pyriformis* Weld des Indes. Il nous a été possible d'examiner des représentants de ces deux espèces dans les collections du British Museum. *E. bicinctus* Gir. y est représenté par une série de 11 ♀ et 2 ♂ de Mackay, Queensland (coll. Turner), déterminée par Waterston, et 1 ♀ de Cairns, Queensland (coll. Perkins), déterminée par nous. De *E. pyriformis* Weld, nous n'avons vu qu'une ♀ des Indes (coll. Cameron), déterminée par Waterston. Les hôtes d'aucune de ces espèces ne sont connus.

Dans une étude biologique sur les guêpes des Iles Philippines (Hawaiian Sugar Plant. Ass., Ent. Ser., Bull. 14, 1919), F. X. Williams mentionne (p. 163) un parasite de *Calligaster* sous le nom de „*Leucospis* sp.". Il est probable qu'il s'agit ici aussi d'un *Epexoclaenoides.* Malheureusement Mr. Williams nous écrit de Hawaii qu'aucun exemplaire de ce Leucospis des Philippines n'a pu être retrouvé.

Les exemplaires reçus de Java diffèrent nettement des deux espèces connues et forment une espèce nouvelle que nous décrivons ci-dessous.

Epexoclaenoides calligastri sp. nov.

♀ ♂ Corps noir, marqué de jaune sur les parties suivantes: le scape; deux bandes transversales sur le pronotum, la première atteignant les épaules où elle est un peu élargie et arrondie, la seconde plus étroite et n'atteignant pas les côtes; deux bandes longitudinales sur le mesonotum, une de chaque côté en face

des axilles; les côtés, largement, et le bord postérieur, plus étroitement, du scutellum; les métapleures; le troisième segment abdominal, sauf le long du bord postérieur; une large bande transversale avant l'extrèmité du cinquième segment; et le bout de l'abdomen de chaque côté de la base de la tarière. Pattes jaunes, les hanches et la base des fémurs antérieurs et médians noirs ou bruns; aux pattes postérieures les hanches sont noires, avec une bande jaune longitudinale dessus et le bout jaune dessous, les fémurs sont jaunes avec une large bande noire oblique s'élargissant de la base au bout, où elle recouvre tous les denticules, les tibias sont jaunes, noirs intérieurement et les tarses sont jaune-orangés. Flagelle des antennes brun-orangé, ainsi que les mandibules, les axilles et la base du premier segment de l'abdomen. Ailes hyalines, avec une tache brune au bout en haut, une zone triangulaire allongée brunâtre derrière la nervure stigmale et une petite tache chitineuse vers le quart inférieur de l'aile.

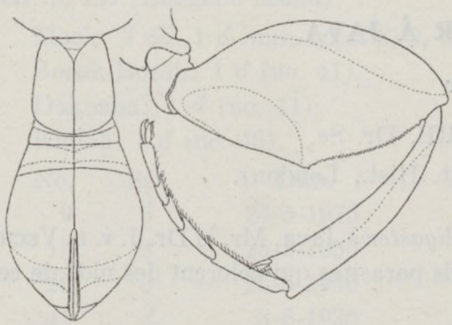

Fig. 1. *Epexoclaenoides calligastri* sp. nov. ♀. Abdomen et patte postérieure.

♀. Tête transverse, très étroite derrière les yeux, avec une carène transversale nette derrière les ocelles. Yeux grands, un peu excavés en avant, entièrement ciliés; ocelles en triangle abaissé, les ocelles postérieurs aussi éloignés du bord des yeux que de l'ocelle médian. Vertex réticulé, ruguleux; face couverte de cils blancs; joues courtes; sillon frontal relativement court, mais assez profond, arrondi en haut, transversalement striolé à l'intérieur.

Antennes de 12 articles, insérées un peu au dessus du milieu de la face. Scape court, ne dépassant pas le haut du sillon frontal; pédicelle arrondi, pas plus long que large; les 7 articles du funicule s'élargissant progressivement, les premiers un peu plus longs que larges, les derniers subcarrés; massue pas plus large que le funicule, les 3 articles env. aussi longs que larges, le dernier pointu.

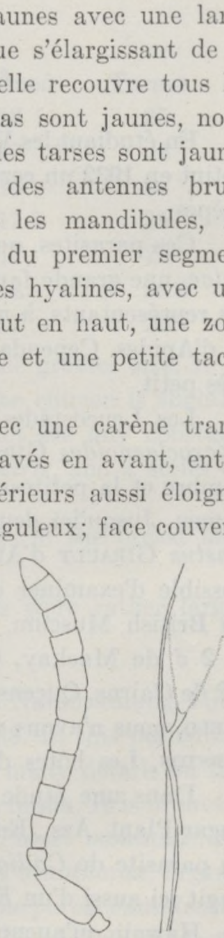

Fig. 2. *Epexoclaenoides calligastri* sp. nov. ♀. Antenne et nervature des ailes.

Thorax entièrement couvert d'une réticulation forte et serrée, mat. Pronotum avec une carène transversale en avant, derrière le cou, et deux autres carènes transversales faiblement indiquées et courtes, l'une entre les deux bandes jaunes, l'autre au milieu de la deuxième bande jaune. Mesonotum un peu moins long que large, à réticulation plus forte que sur le pronotum et le scutellum. Scutellum large, peu bombé, arrondi en arrière. Postscutellum avec une faible fossette au milieu. Propodeum avec une carène médiane et des sillons latéraux; stigmates grands, ovals. Ailes grandes, dépassant légèrement le bout de l'abdomen; nervures fortes, épaisses, la nervure

marginale plus courte que la nervure stigmale, celle-ci courtement bifurquée au bout; nervure postmarginale longue, s'étendant jusqu'à la tache apicale. Pattes postérieures avec les hanches grandes, ruguleuses; les fémurs env. deux fois plus longs que leur plus grande largeur; les dents très petites, même la première, au nombre d'env. 35.

Abdomen avec le premier segment finement ruguleux, divisé par une carène longitudinale; 2me à 4me segments très courts, le 2me presque caché en haut, le 4me un peu plus long que le 3me, chacun s'élargissant sur les côtes; 5me segment très grand, plus haut et plus large que les précédents, formant avec le 4me et les derniers un ovoide un peu plus long que large. Sillon de la tarière profond, s'étendant jusqu'à la partie la plus haute du 5me segment, entre les deux bandes transversales jaunes. Valves de la tarière un peu élargies au bout.

♂ Tout à fait semblable à la femelle, dont il ne se distingue que par la forme de l'abdomen. Le 1er segment est moins ruguleux, avec ponctuation distincte, et un peu plus allongé; le 2me est très court, avec une rangée transversale de points, les segments suivants sont soudés et forment un ovoïde deux fois plus long que large, sans sillon dessus.

Longueur 6½ à 9 mm.

Java, Mt. Gedeh, Tapos, 700 - 800 m alt., 5 ♀♀ 1 ♂, 5.vii.1932, 7 ♀♀, iv.1933. (J. v. d. Vecht).

Obtenus des nids de *Calligaster cyanopterus* Sauss.

Les trois espèces de ce genre peuvent se distinguer par le tableau suivant.

1. Tarière très courte, dépassant à peine la partie verticale du bout de l'abdomen; le sillon de la tarière ne s'étendant que jusqu'à la deuxième bande jaune, sur à peine le 1/5 du dos du 5me segment. 1er segment rougeâtre, taches jaunes du thorax étroites .... *E. pyriformis* Weld
— Tarière plus longue, le sillon s'étendant au moins jusqu'au milieu du dos du 5me segment 2
2. Deuxième partie de l'abdomen courte, arrondie, pas plus longue que haute; le sillon s'étendant jusqu'un peu au delà de la seconde bande jaune, env. aussi long que la moitié du dos du 5me segment. Pétiole et plusieurs parties du thorax rougeâtres .... *E. bicinctus* Gir.
— Deuxième partie de l'abdomen un peu plus longue que haute; le sillon plus long, s'arrêtant entre les deux bandes jaunes, et plus des 2/3 aussi long que le dos du 5me segment. Pétiole et thorax noirs ou à peine rougeâtre près des taches jaunes .... *E. calligastri* sp. n.

HERPETOLOGISCHE NOTIZEN XIX.

Ueber Pigmentierungsanomalien bei malaiischen Reptilien.

Von

Dr. FELIX KOPSTEIN
(Magelang, Java).

Mit 4 Photographien und 1 Karte.

Seit meiner Beschreibung eines Flavinos von *Ptyas korros* (Schlegel) und eines Albinos von *Amblycephalus carinatus carinatus* (Wagler) in Treubia (XV; 1936; pag. 405/6) fand ich in verschiedenen kleinen Sammlungen noch andere malaiische Schlangen, welche durch Über- oder Unterpigmentierung stark vom typischen Zeichnungs- und Färbungsbild abweichen. Da unsere Kenntnis der Färbungsmutationen und anderweitigen Abweichungen der Färbung und Zeichnung im allgemeinen gering ist und bei indomalaiischen Reptilien praktisch überhaupt noch fehlt, so sollen die bisher bekannt gewordenen Fälle hier mitgeteilt werden.

Die ersten 2 Fälle von Pigmentmangel bei malaiischen Schlangen bildeten die oben erwähnten *Ptyas korros* und *Amblycephalus carinatus carinatus*. Einen weiteren Fall von wahrscheinlich komplettem Albinismus stelt ein Praeparat von *Enhydrina schistosa* (Daudin) vor (Fig. 1). Diese Seeschlange wurde im Jahre 1936 von Dr. Ch. J. Gremmée im Indragirifluss bei Tambilahan (Sumatra) gefangen. Es handelt sich um ein junges Exemplar von 42 cm Länge, dessen Pholidose keine Abweichung zeigt. Nach M. Smith (Sea-snakes. London 1926) sind Färbungsvariationen bei *Enhydrina* selten. Dieses Praeparat befindet sich gegenwärtig im Besitz des Rijksmuseums van Natuurlijke Historie in Leiden (Holland).

Ein weiteres Beispiel bieten 2 Exemplare von *Trimeresurus gramineus albolabris* Gray, welche Dr. K. W. Dammerman auf einer der Kleinen Sunda-Inseln, Soemba, sammelte (Fig. 2). Soweit die Alkoholpraeparate ein Urteil gestatten, haben wir es auch hier mit echtem Albinismus zu tun. Melanin fehlt bei beiden Schlangen völlig. Die auf der Photographie dunkel erscheinende Kopfpartie ist die Folge unvollständiger Häutung; sie wird durch übriggebliebene Epidermisreste vorgetäuscht. Beide Praeparate sind in der Reptiliensammlung des Zoologischen Museums in Buitenzorg (Java) bewahrt.

Relativ häufig kommt auf Java Albinismus bei der Schildkröte *Amyda cartilaginea* (Boddaert) vor. Diese Albinos werden in der mittel-javánischen Stadt Djokjakarta, im Kraton, geregelt in einem Teich gehalten und als heilig angesehen. Bei dieser Schildkröte fand J. C. van der Meer Mohr (Miscellanea Zoologica Sumatrana. XL) auch ein leucistisches Exemplar in Serdang (Sumatra).

Einen Fall einer partiell leucistischen Mutation bei *Bungarus candidus* (L.) fand ich im Besitz von Dr. JACOBSON in Bandoeng. Diese Schlange wurde von Herrn J. Ros im Jänner 1937 auf der Plantage Soekadana (± 50 m), bei Indramajoe, in West-Java gefangen (Fig. 3). Sie stammt ungefähr aus demselben Gebiet als meine in Treubia (XIV; 1932; pag. 73/77 und XV; 1936; pag. 265/66) beschriebenen *Bungarus javanicus* und erinnert an jenes bei Linggadjati erbeutete ♂ (Fig. 4), bei welchem ich bereits an die Möglichkeit einer Mutation dachte. Wenn es sich bei diesem Exemplar tatsächlich um eine Mutation handelt, so haben wir es mit einer progressiven, bei dem in Fig. 3. abgebildeten Exemplar aus Soekadana, mit einer regressiven Mutation zu tun. Als erscheinendes, resp. verschwindendes Merkmal fasse ich dabei die Summe des dunklen Pigmentes auf.

Das bei Soekadana gefangene Exemplar ähnelt prinzipiell jenem aus Linggadjati, nur das bei ersterem die weisse Schuppenzeichnung überwiegt, bei letzterem aber die schwarze. Bei beiden sehen wir auf der vorderen Rumphälfte ± 11, kaudalwärts an Intensität abnehmende, schwarze Querbänder. Bei beiden fehlen sie auf der hinteren Körperhälfte. Die Schuppen sind auf der kaudalen Hälfte schwarz, mit weissen Rändern; bei dem Exemplar aus Linggadjati überwiegt die schwarze, bei jenem aus Soekadana die weisse Farbe.

Das ♂ aus Linggadjati zeigt also im allgemeinen die Tendenz zur Verdunkelung. Sogar die sonst hellen Zwischenräume zwischen den schwarzen Querbändern sind überwiegend dunkel gefärbt, so dass wir es mit einer submelanistischen Mutation zu tun haben. Das Exemplar aus Soekadana dagegen (bei welchem sich das Geslecht wegen unvollständiger Konservierung nicht feststellen lässt) weist eine Tendenz zur Unterpigmentierung auf. Es macht einen vorwiegend hellen Eindruck, welcher dadurch hervorgerufen wird, dass sowohl auf den zwischen den schwarzen Bändern gelegenen Partien, als auch auf der distalen Körperhälfte die weisse Farbe überwiegt.

Bei beiden Exemplaren ist die Unterseite hell, weisslich. Die schwarzen Querbänder greifen nicht auf die Ventralia über, was bei Bungarus candidus zum Teil wohl der Fall ist. Bei dem ♂ aus Linggadjati tragen die lateralen Enden der Bauchschilder dunkle Flecke, beim Exemplar aus Soekadana sind die Ventralia einfärbig weiss.

Während bei *Bungarus candidus candidus* die schwarzen Querbänder auf dem Schwanz auf die Unterseite reichen, hier also schwarze Ringe bilden, ist bei dem Soekadana-Stück die Schwanzunterseite einfärbig weiss; bei dem Linggadjati ♂ ist bloss die Schwanzspitze unterseits dunkel.

Merkwürdig ist, dass die Mutationen und die als *Bungarus javanicus* beschriebenen Schlangen, welche in hohem Masse an das Linggadjati ♂ erinnern, einem relativ kleinen Gebiet an der Nordküste West-Javas entstammen (Fig. 5), während ich bei Hunderten von *Bungarus candidus* aus anderen Teilen Javas und von den anderen Sunda-Inseln keine Tendenz zu Mutationen beobachten konnte.

Eine physiologische Erklärung dieser, auf ein kleines Areal beschränkten Mutationen fehlt. Feststeht bloss, dass im selben Gebiet normal gefärbte und

gezeichnete *Bungarus candidus* häufig sind, und dass in anderen Gebieten Javas (oder vielleicht überhaupt im gesamten Verbreitungsareal der Art) derartige Abweichungen bisher nicht gefunden wurden. Eine Vermehrung des Melanins bis zu völligem Melanismus fand ich in einigen Hafenstädten an der Nordküste Javas auch bei *Rattus norvegicus*. Auch hier ist der verantwortliche Faktor unbekannt. In anderen, klimatisch und ökologisch (scheinbar!) gleich beschaffenen Bezirken wurden bisher keine schwarzen *R. norvegicus* beobachtet, so dass es schwer fällt, die Temperatur, Feuchtigkeit oder Ernährung zur Erklärung heranzuziehen.

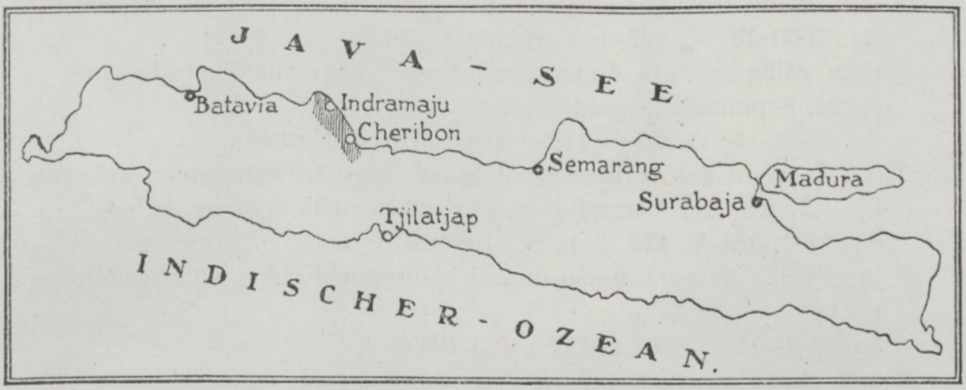

Fig. 5. Schaffiert ist das Gebiet, in welchem *Bungarus javanicus* und die Mutationen von *Bungarus candidus* gefunden wurden.

Eine räumliche Isolierung spielt bei den vorliegenden Fällen von Mutationen bei *Bungarus candidus* keine Rolle. Das Gebiet um Cheribon und Indramajoe ist nach keiner Richtung und in keiner Weise vom übrigen Java getrennt. Eine Beantwortung der Frage, ob es sich tatsächlich um Mutationen handelt, wird erst ein umfassender Züchtungsversuch ergeben, den ich in den folgenden Jahren anstellen zu können hoffe.

Eine submelanotische Population bei *Psammodynastes pulverulentus* beschrieb ich in Treubia XVI; 1937; p. 242/243 von der Insel Enggano (Sumatra).

Als einziges Beispiel für Melanismus aus dem indo-australischen Archipel (von dem fraglichen Fall der *Naja naja sputatrix* abgesehen) beschrieb ich in Treubia XV; 1936; p. 257 bei *Boiga dendrophila atra*, von welcher mir gegenwärtig 12 Exemplare vom typischen Fundort (Makale, Celebes) vorliegen. Alle sind oberseits dunkel blauschwarz, irrisierend und unten einfärbig dunkel blaugrau. Bloss einzelne Kehlschilder und Schuppen zeigen Spuren einer gelblichen Wölkung, als letzte Reste der für *Boiga dendrophila* charakteristischen grellgelben Querbänderung.

Die ersten 4 Exemplare, worunter die Type, wurden in Treubia (XV; 1936; pag. 257) beschrieben. Darnach erhielt ich von demselben Sammler, Herrn MOHAMAD MANSJOER, vom selben Fundgebiet noch 8 gleiche Exemplare, welche ich hier beschreiben will:

ad. ♂; ganz schwarzes Ex., bloss mit einzelnen helleren Flecken auf den Kehlschildern und den vordersten Ventralen.
Sq. 23-21-15; V. 232 + 1; Sc. 106/106 + 1.

ad. ♂; Färbung als oben.
Sq. 23-21-15; V. 228 + 1; Sc. 94/94 + 1.

ad. ♂; Färbung als oben; gelbliche Flecke kaum sichtbar; beinahe einfarbig blauschwarz.
Sq. 21-21-15; V. 230 + 1; Sc. 104/104 + 1.

ad. ♀; ganz schwarz, mit einzelnen, kleinen, gelblichen Flecken auf der Kehle.
Sq. 23-23-15; V. 238 + 1; Sc. 105/105 + 1.

ad. ♂; oben völlig schwarz; unten bläulich grau; Kehle gelblich gefleckt.
Sq. 21-21-15; V 227 + 1; Sc. 88/88 + 1.

ad. ♂; oben völlig schwarz, Unterseite hell weisslich; alle Ventralia grau gefleckt. Supralabialia grau-schwarz.
Sq. 21-21-15; V. 225 + 1; Schwanzspitze abgebrochen.

1 s.ad. ♂; ebenso wie das vorhergehende Stück; oben schwarz, unten weissgrünlich; Ränder der Ventralia dunkel. Subcaudalia schwarz gefleckt.
Sq. 21-21-15; V. 222 + 1; Sc. 103/103 + 1.

ad. ♀; oben völlig schwarz, unten dunkel blau-grau, Kehle lichter, gelblich gefleckt.
Sq. 21-21-15; V. 235 + 1; Sc. 103/103 + 1.

Die 12 bisher gefundenen Exemplare dieser melanistischen Mutante befinden sich teils im Zoologischen Museum in Buitenzorg, teils im Rijksmuseum v. Natuurlijke Historie in Leiden.

Wir haben es hier mit einer Nigrinopopulation zu tun, welche in einem umschriebenen Bezirk, in Celebes, eine eigene geographische Rasse formt. Dieser Schluss ist schon darum gerechtfertigt, da in diesem Gebiete bisher keine andere *Boiga dendrophila* gefunden wurde, *B. d. atra* sich also vikariirend verhält.

Als Einzelerscheinung fand ich im indo-australischen Archipel kein einziges Nigrino.

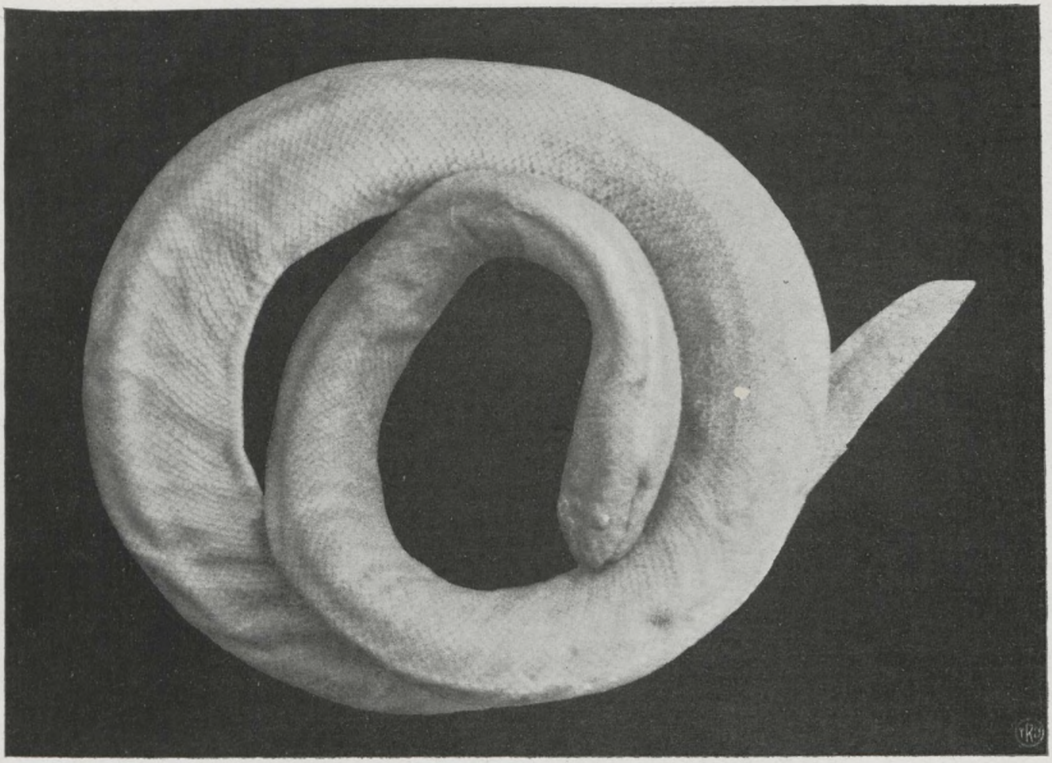

Fig. 1. Albino von *Enhydrina schistosa*.

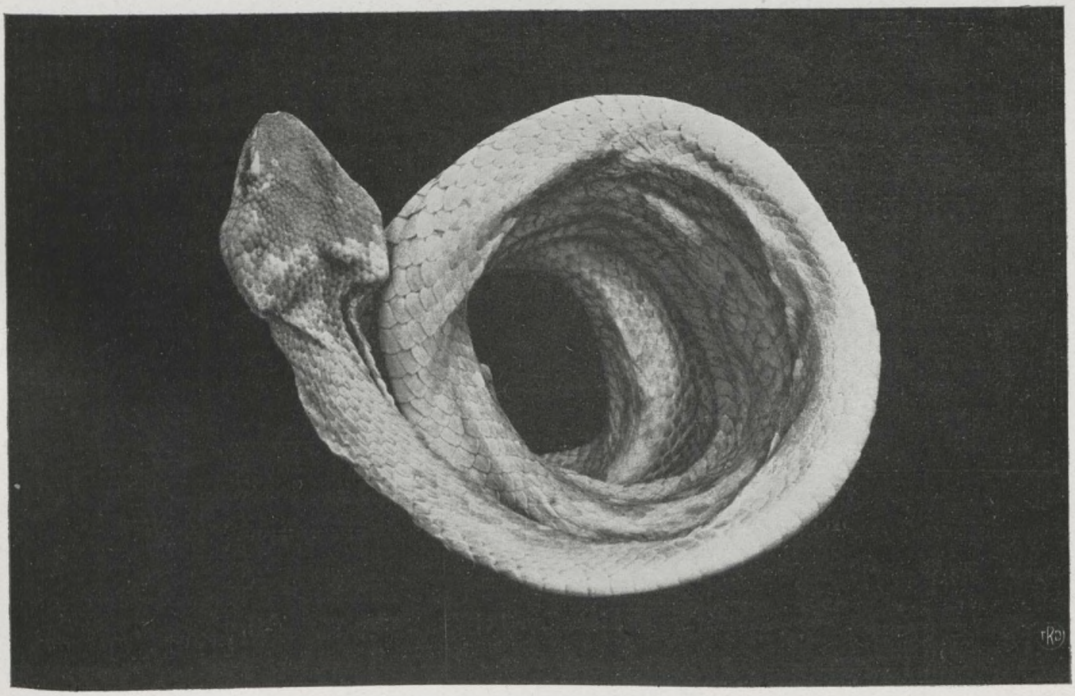

Fig. 2. Albino von *Trimeresurus gramineus albolabris*.

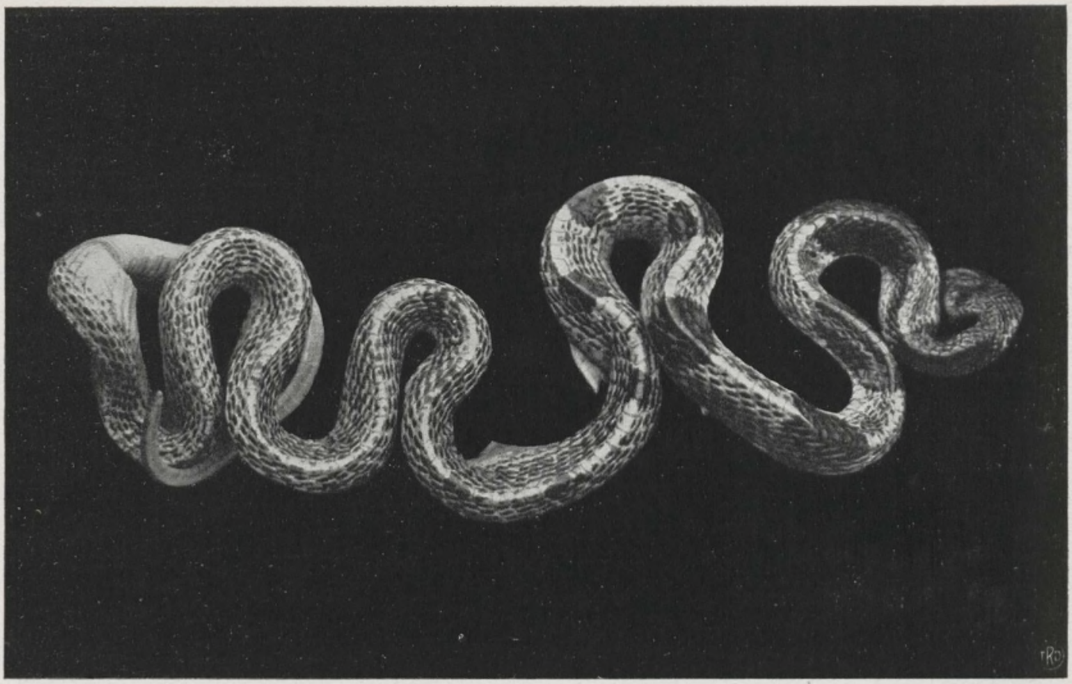

Fig. 3. Leucistische Mutation bei *Bungarus candidus*.

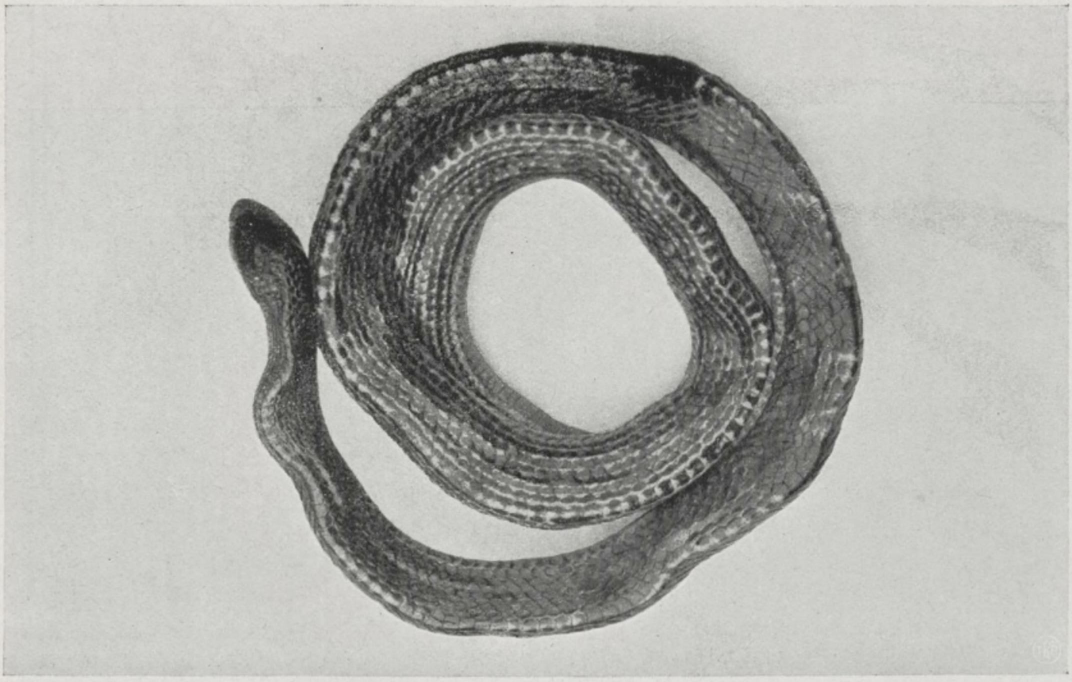

Fig. 4. Melanistische Mutation bei *Bungarus candidus*.

OBSERVATIONS MADE BY E. L. TÄNZER AND JHR. W. C. VAN HEURN WITH REFERENCE TO THE PROPAGATION OF THE VARANUS KOMODOENSIS OUW.

In his publication on the *Varanus komodoensis* OUW. (Nat. Tijdschr. v. Ned. Ind., vol. 97, 1937, p. 193) Dr. J. K. DE JONG had to state: "The biology of its propagation, we regret to state, as yet remains a closed book" [1]. The Editor of Treubia has now received a report on observations with reference to the mating and the depositing of eggs, sent in by Mr. E. L. TÄNZER, made in the Sourabaya Botanical and Zoological Gardens, and in connection therewith also with reference to the results of the examination of a few of these eggs on the part of Jhr. W. C. VAN HEURN. Both these gentlemen were good enough to put their notes at the disposal of the Editor who has prepared therefrom the following extract.

The animals.

In the Sourabaya Botanical and Zoological Gardens there are 4 Komodo Varanus, as follows:

1. a large male (length 2.77 m) presented in 1927 by Mr. H. R. ROOKMAAKER, at that time Assistent Resident of Flores;
2. two specimens, both of them probably males (length 2.40 and 2.50 m, respectively), caught by members of the expedition to Komodo in the spring of 1935; this expedition was headed by Mr. F. F. SCHOENMAKERS, at that time the Director of the Gardens, now deceased;
3. a small female (length 1.55 m), presented also by Mr. H. R. ROOKMAAKER in 1927. This female, which has grown little or not at all since that time, deposited eggs twice, once about 6 years ago, and once 4 years ago, in neither instance, however, fertilized.

Copulation.

On July 4th, 1937, Mr. CH. TÄNZER witnessed the copulation between the female Varanus and one of the two smaller males, in the Gardens since 1935.

Subsequently Mr. G. HOMPES, the Manager of the Gardens, witnessed some more copulations, as communicated by him on July 10th, 1937. Such copulations were repeated several times since.

In the course of the copulation the male lies over the female, in the usual manner.

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[1]) See also the article published by Dr. L. D. BRONGERSMA: Über die Ei-ablage und die Eier von Varanus komodoensis OUWENS. Zoöl. Garten Leipzig, 1932, N.F. 5, pp. 45 - 48. (But the behaviour of the female here described was most likely altogether abnormal).

When the urge to copulate had noticeably declined, the female, on July 24, 1937, was transferred to a separate enclosure which was partly shaded.

The depositing of the eggs. [2])

The floor of the "lying-in room" had been dug out to a depth of from 1 - 1½ metres, and had been filled in with humus and also raised by means of humus.

On one of its sides, at the foot of the hillock, an entrance was made of plates of concrete resting upon concrete corbels. The female, immediately upon being freed within its new enclosure, made use of this entrance by digging itself in there. During the greater part of the day the animal remained in its lair.

It was very rarely seen outside. It took food regularly. So as not to frighten the animal no night observations were made with lamps or lights.

On August 13, 1937, it was discovered that the animal had laid eggs. At that time two eggs had been deposited outside the actual breeding place, at about 1½ metres distance from the entrance to the lair. When after two days both eggs were still lying there, one of them was taken away to find out, if possible, whether it had been fecundated. The examinations made by Jhr. VAN HEURN proved that the egg was entirely addled, so that it was impossible to establish the development of an embryo.

The other egg had utterly disappeared a couple of days later.

On December 14, 1937, Mr. HOMPES saw the animal digging into the side of the hillock. So as not to disturb it he did not further pursue his observation. A couple of hours later he discovered that in the spot where the animal had been digging there was no hole; only the soil showed signs of having been rooted up. Upon further investigation a nest was found here. One of its eggs was extracted to be submitted to a second examination, but so as not to disturb the nest the number of eggs deposited was not ascertained.

The eggs.

The weight of the egg taken out of this nest on December 14th amounted to 136 grammes. Its colour was evenly white, with a circlet of purplish red spots round one of the poles. The egg shell was parchment-like, and within the circlet of spots mentioned it was softer and less elastic than was the remainder of the shell. The egg was not a perfect ellipsoid, and exhibited a few dents that need not be attributed to decay but could very well have been caused by the evaporation of water. It was opaque. Upon being opened a caked layer of a fairly thick substance, of a rose to creamish yellow colour, was found deposited on the inside of the shell, within which layer, surrounded by a disorganized creamish mass, a dead embryo was discovered. Though data are lacking that might suggest the age of the egg, it is nevertheless surmised that it may have developed for two or three months, whilst the embryo probably had died about a month prior to the egg having been opened.

[2]) For a reproduction of the egg see the article of Dr. L. D. BRONGERSMA, referred to in Note 1.

Although, therefore, this egg contained a dead embryo, the nest was not exposed until January 10, 1938, when it proved to contain 14 dessicated egg shells.

In the course of the exposure of this nest a second nest with eggs was discovered close to the first one. It had been made at a greater depth (± 45 cm) and contained 10 eggs, one of which was empty and dessicated. One of the 9 undamaged eggs was taken away and examined. It weighed 176 grammes. Its colour was a dirty white with an admixture of a somewhat rusty tint. The shell was leathery, the length of the empty egg shell being ± 92 mm, and its transverse section 60 mm. The shell weighed 6 grammes. Upon being opened it was found to contain a living embryo which had not become immersed in the mass of the light yellow yolk, as Jhr. VAN HEURN had very often found in the case of snake eggs. The white of the egg was clear and looked somewhat like the fresh white of a hen's egg. The area vasculosa, situated against the egg shell, was less definitely developed than in the case of hatching birds' eggs, and upon incision exhibited but slight bleeding. As had been done with the preceding embryo, so also this one was fixed in alcohol-formaline according to Apathy.

On February 18 the nest was once again laid open.

The eight remaining eggs at that time were all of them more or less dented and shrivelled.

The examination of these eggs resulted in the following:

Colour of an uneven rustiness with but a few small purple spots. Of the 8 eggs 6 were perforated, one was torn across, and only one had remained intact.

In two of the eggs there was no embryo, their contents being dessicated and disorganized.

The remaining 6 eggs contained embryos in various stages of development, and in various stages of decomposition. The egg that had remained intact contained the largest embryo, measuring 12 cm from snout to anus, and 27 cm from snout to the tip of the tail. The umbilical cord and the membranes of the yolk mass still were almost intact. It must have died after the last but one egg examination on July 10, 1938; the other 5 embryos prior to that time.

Also in these eggs the embryo in all cases was found to lie outside along the yolk mass. The yolks were all of them but little consumed, and in weight and in volume were several times larger than the embryo pertaining to each.

Also these six embryos, like the previous two, were fixed with alcohol-formaline according to Apathy.

The embryonic material, together with 25 egg shells, was placed at the disposal of the Zoological Museum at Buitenzorg, where it is to be submitted to a closer anatomical examination.

Final Remarks.

It is clear that the embryos had died at a comparatively early stage of their development, whilst death had ensued at various periods. In view of the fact that one of the last eight eggs was still undamaged the cause of death cannot

have been violence. It is not likely that rats were the cause, nor were any larvae of flies found anywhere, whilst if they had been damaged by the nails of the mother animal the eggs, on account of its great weight, would have been damaged more severely.

The primary cause, therefore, of the failure of these two nests will most probably have to be looked for in the inappropriate soil. This was too close, and perhaps also too moist, so that there was insufficient air for the embryos to breathe, impairing their development and finally resulting in their death.

Also in other animals in the course of the years too great value has sometimes been attached to the warmth required for incubating in the humus within which the eggs are deposited.

Very often the eggs themselves are warmer than their surroundings, so that the heat seems to emanate rather from the embryo in the course of its development than from the hatching nest material.

It is to be hoped that before long it may again be possible to induce a *Varanus komodoensis* to procreate, in which case there may be a better chance of the outcome being favourable in view of the experience now gained.

MISOTERMES EXENTERANS n. g. n. sp., EINE PARASITISCHE FLIEGE AUS DER FAMILIE DER PHORIDEN,

welche die Entstehung myiagener Soldaten bei Macrotermes gilvus Hag. in Java verursacht.

Von

H. SCHMITZ S. J.

(Valkenburg, L., Nederland)

(Mit biologischen Beobachtungen von Dr. L. G. E. KALSHOVEN, Buitenzorg, Java).

„Man kann nicht behaupten, schrieb LUNDBECK 1922 (Diptera Danica Vol. VI 82), dass wir über die Entwicklungsstadien der Phoriden gut unterrichtet seien. Von vielen Gattungen sind die ersten Zustände noch unbekannt, auch dann, wenn einzelne Arten durch Zucht erhalten wurden, sodass man wenigstens weiss, wovon die Larve lebt".

Diese Feststellung gilt auch heute noch, sowohl von den Phoriden im allgemeinen, als ganz besonders von der Unterfamilie der Aenigmatiinen; obwohl bekannt ist, dass deren Arten sämtlich bei Ameisen und Termiten leben, ist doch bis jetzt von keiner derselben die Entwicklungsgeschichte beschrieben worden. [1])

Es war mir daher eine grosse Freude, von Herrn Dr. KALSHOVEN in Buitenzorg reichliches Material einer neuen Aenigmatiinengattung und -Art zu erhalten, das nicht nur viele Mänchen und Weibchen, sondern auch alle Entwicklungsstadien umfasste und ausserdem von wertvollen Aufzeichnungen über die Biologie des Tieres begleitet war. Der neue Parasit ist zudem nicht bloss für die Kenntnis der Phoriden von Bedeutung, sondern interessiert auch die Termitenforschung in hohem Grade, weil er das Problem der sogenannten myiagenen Soldaten neu aufrollt.

Die Aufzeichnungen Dr. KALSHOVENS werden seinem Wunsche entsprechend am Ende meiner Abhandlung als selbständiger Beitrag abgedruckt. Ich möchte nicht unterlassen, Herrn Dr. KALSHOVEN auch an dieser Stelle für die mir freundlichst zugedachte Beteiligung an der Untersuchung seines bemerkenswerten Fundes verbindlichst zu danken. Ferner bin ich Herrn Dr. E. O. ENGEL, München für die Herstellung der auf die erwachsene *Misotermes*larve bezüglichen Zeichnungen zu Dank verpflichtet.

[1]) H. DONISTHORPE erwähnt in mehreren Schriften Puparien von *Platyphora* VERR., aber ohne sie näher zu beschreiben.

Inhaltsübersicht.

1. Historisch-Kritisches.

Vor zwölf Jahren berichtete N. KEMNER in zwei Abhandlungen über „eine merkwürdige parasitische Fliegenlarve, die im Kopfe von Termitensoldaten lebt und durch die Verunstaltung desselben Veranlassung zur Aufstellung eines besondern Termitengenus mit zwei Arten gegeben hat" (KEMNER 1925 a und b). Es handelte sich um die Gattung *Gnathotermes* HOLMGREN mit den beiden Arten *aurivillii* HOLMGR. von der Insel Billiton und *havilandi* HOLMGR. von Malacca. Beide Arten waren auf ein äusserst spärliches Material von Soldaten gegründet worden, von *aurivillii* lagen zwei dem Stockholmer Museum gehörige Soldaten von Billiton samt einem von Singapore (Münchener Mus.) vor, von *havilandi* nur ein einziger Soldat, der zusammen mit Cotypen von *Macrotermes malaccensis* im Britischen Museum vorhanden war. Bei Erörterung der systmatischen Stellung seines Genus *Gnathotermes* hatte HOLMGREN (1912 S. 22) bemerkt: „Freilich erscheinen die Tiere etwas fremdartig: einerseits besitzen sie habituelle Ähnlichkeit mit *Termes*, andererseits mit *Syntermes* und sogar *Rhinotermes*".

Denselben fremdartigen Eindruck, aber mehr im Sinne einer pathologischen als einer systematischen Abweichung machten später die Stockholmer *aurivillii*-Typen auf KEMNER; die Köpfe erschienen ihm wie aufgeblasen und stellenweise leer. Dies führte ihn dann zu der interessanten Entdeckung, dass diese Köpfe je eine Fliegenlarve beherbergten, welche „die Köpfe tatsächlich ganz ausgefressen und mit ihrer Masse schliesslich wieder erfüllt haben".

Es war der erste Fall eines Insektenendoparasiten bei Termiten, der damit bekannt wurde, und KEMNER behandelte, so weit ihm dies möglich war, den ganzen Komplex der sich daran knüpfenden Fragen. Aus den morphologischen Eigentümlichkeiten der Larve schliesst er, dass es sich wahrscheinlich um eine im dritten Stadium befindliche Muscidenlarve handele, die zu einem besondern Genus gehöre. Indem er sie *„Larva termitovorax"* nannte, hat er wohl den Speziesnamen bereits festlegen wollen.

Auf die Frage: Wie ist nun diese Larve in den Termitenkopf gekommen? antwortet K. mit dem Hinweis auf die Lebensweise gewisser Phoriden, besonders des *Apocephalus pergandei* COQUILL., dessen Larve in den Köpfen lebender Ameisen schmarotzt und zuletzt die Halsregion der Wirtsameise zerbeisst, sodass diese buchstäblich geköpft wird (Apo-cephalus!). In ähnlicher Weise sei anzunehmen, dass die Sache bei dem Termitenparasiten verläuft. — Es ist möglich, dass KEMNERS *Larva termitovorax* ähnlich wie die *Apocephalus*larve den Kopf

des Wirtes abbeisst und aus dem abgefallenen Kopf hervorkriecht, um sich ausserhalb zu verpuppen, aber mit Rücksicht auf das Verhalten von *Misotermes* ist auch eine andere Annahme erlaubt, wie wir gleich sehen werden.

Auf jeden Fall besteht aber der folgende, von K. hervorgehobene Unterschied. Während die Tätigheit der *Apocephalus* larve sich auf das Wegfressen der Weichteile des Kopfinnern beschränkt, ohne dass der Kopf des Wirtes eine Gestaltveränderung erleidet, sind „die Köpfe der ... *Gnathotermes*typen ... zweifelsohne recht stark deformiert, eine Art von Gallenbildung darstellend, was darauf deutet, dass die betreffenden Termitensoldaten schon im Larvenstadium von Parasiten beeinflusst wurden". K. postuliert daher einen Angriff des Parasitenweibchens auf die „ausschliesslich in den tieferen Nestteilen lebenden" Soldatenlarven, vermutlich in den späteren Stadien ihrer Entwicklung, etwa vor der letzten Häutung. Die Fliege müsse also tief in die Termitennester eindringen, um ihr Opfer aufzusuchen. Sie habe wahrscheinlich einen grossen hornigen Ovipositor (1925 a S. 6).

Die Hypothese einer beträchtlichen parasitischen Deformation des *Gnathotermes*kopfes weiter verfolgend stellt K. die Frage: Wie weit ist die Deformierung gegangen und was würde *Gnathotermes* ohne diese sein? (l.c. S. 8 ff). Er antwortet: Sieht man von den Mandibeln ab, so sind die beiden mir vorliegenden Typexemplare sowie das abgebildete Exemplar von *Gn. havilandi* ohne weiteres zu dem Genus *Termes* [*Macrotermes*] zu rechnen und stimmen mit diesem vollkommen überein". Aber auch die scheinbar so sehr von *Termes* [*Macrotermes*] abweichenden *Gnathotermes*mandibeln mit ihrem ungewöhnlich grossen, hellen Basal- und kleinen schwarzen Spitzenteil lassen sich nach K. auf *Macrotermes*-mandibeln zurückführen, wenn man berücksichtige, dass der Parasit hauptsächlich die Kiefermuskulatur der Soldatenlarve zerstört, dadurch die Mandibeln ausser Funktion setzt und ihre normale Ausbildung und Chitinisierung verhindert, wobei die geschwollene Basalpartie auf eine zu früh abgebrochene Entwicklung und ein Verbleiben in einem teilweise jugendlichen Stadium hinweise (l.c. S. 9). Die Ausgangsart muss also in der Gattung *Termes* [*Macrotermes*] gesucht werden. K. macht es sehr wahrscheinlich, dass beide vermeintlichen *Gnathotermes*-arten deformierte Soldaten von *Macrotermes malaccensis* HAV. sind. Zusammen mit *malaccensis* wurde ja auch die *havilandi*-Type eingesammelt.

In der zweiten Abhandlung (1925 b) bespricht K. das dem Münchener Museum gehörige cotypische Exemplar von *Gn. aurivillii*, das von Singapore stammt. Er stellt fest, dass es zusammen mit *Macrotermes malaccensis* gefangen wurde und von den beiden andern *aurivillii*-Typen in solcher Weise abweicht, dass man es eher zu *Gn. havilandi* rechnen müsste, wenn das Genus *Gnathotermes* mit seinen beiden Arten nicht überhaupt unhaltbar wäre. Der Kopf dieses Exemplars enthält keine Fliegenlarve, ist aber vollkommen leer und hohl, ohne mehr als kaum bemerkbare Spuren von den grossen Mandibularmuskeln, Gehirn und sonstigen Eingeweiden des Kopfes. Also „ohne jeden Zweifel ist auch hier eine *Larva termitovorax* in Tätigkeit gewesen, die alle weichen Teile des Kopfes weggefressen hat.... Über den Weg nach aussen, den die Larve genommen hat, ist

nichts Sicheres zu ermitteln, wahrscheinlich ist er in der Halsregion gelegen, weil der Kopf innerlich ganz unverletzt erscheint".

Aus einer tabellarischen Übersicht (l.c. S. 162) der Längen- und Breitenmasse verschiedener Körperteile der zwei „*aurivillii*" und der zwei „*havilandi*" geht hervor, dass sie paarweise in gewissen Eigenschaften übereinstimmen. Die „*aurivillii*" (von Billiton) haben beide 18-gliedrige Antennen, kurzspitzige Mandibeln und ein sehr schmales Mesonotum. Die beiden „*havilandi*" (von Malakka) haben beide mehr langspitzige Mandibeln, 19-gliedrige Antennen und ein relativ viel breiteres Mesonotum. Auf diese Übereinstimmungen legt indes K. keinen besondern Wert. Er betont mehr die Ungleichheit aller vier Exemplare untereinander, besonders in der Kopfbreite. Solche Ungleichheiten seien ja gerade infolge der pathologischen Natur dieser Erscheinungen zu erwarten. So richtig dies nun auch an sich ist, scheint mir doch auch das Faktum der paarweisen Übereinstimmung der von Billiton einerseits und von der Malaiischen Halbinsel anderseits herstammenden Exemplare erklärungsbedürftig. Mit Rücksicht auf die geographische Verschiedenheit ihres Vorkommens darf man wohl die Vermutung hegen, dass es sich um zwei zwar nicht generisch, aber wohl spezifisch verschiedene Parasiten handelt, deren Verschiedenheit sich im Charakter der von ihnen bei ein und derselben *Macrotermes*art hervorgebrachten Deformierungen spiegelt. Diese Vermutung liegt auch deswegen nahe, weil ich sehe, dass es auch bei *Macrotermes gilvus* zwei verschiedene Parasiten in geographisch getrennten Arealen gibt, die verschiedene Deformationen erzeugen.

Der mir vorliegende Parasit von *Macrotermes gilvus* verlässt, bevor der befallene Termitensoldat stirbt, dessen ausgehöhlten Kopf und wandert durch den Thorax ins Abdomen des Wirtstieres, um dort zur Verpuppung heranzureifen. Es schien mir darum erwünscht, an dem von KEMNER studierten hohlköpfigen Münchener Exemplar von *M. malaccensis* nochmals genau zu untersuchen, ob sich die aus dem Kopf verschwundene Larve nicht etwa im Abdomen befinde. Diese abdominale Larve konnte KEMNER entgangen sein; denn bei *M. gilvus* ist sie ohne Dissektion kaum zu sehn. Durch Einbringen in ein stark aufhellendes Medium lässt sich aber ohne irgendeinen verletzenden Eingriff ihre An- oder Abwesenheit sicher feststellen. Herr BARON v. ROSEN in München hatte die Freundlichkeit, mir das Objekt zu diesem Zwecke zugänglich zu machen. Ich fand, offen gestanden wider mein Erwarten, keine Larve im Hinterleib, sondern dessen Eingeweide vollständig intakt, und ebenso verhielt es sich mit dem Thorax. Der Kopf ist in Übereinstimmung mit KEMNERS Angabe völlig leer, aber der Hals ist an einer Stelle zerrissen, was sehr gut zu sehen ist, da ein abgerissenes Muskelbündel aus der Öffnung herausragt. Ich schliesse mich deswegen der Vermutung KEMNERS an, die Larve sei, möglicherweise erst beim Einwerfen des Wirtstieres in Alkohol, an dieser Stelle ausgebrochen, wobei immer noch zweifelhaft bleibt, ob das ihr normaler Weg ins Freie ist.

Ein Jahr nach KEMNER beschreibt SILVESTRI (1926) parasitisch verunstaltete Soldaten von *Macrotermes gilvus* von den Philippinen. Er prägt für solche

Individuen die Bezeichnung „myiagen" (myiagenio). Trotz reichhaltigen Materials, das von ihm selbst an Ort und Stelle gesammelt wurde, hat er die Parasitenimago nicht gezüchtet. Die Dipterenlarve beobachtete er wie KEMNER nur im Kopf des Wirtstieres. Sie weicht im Körperbau von KEMNERS *Larva termitovorax* in systematisch wichtigen Einzelheiten ab; sie ist metapneustisch, nicht amphipneustisch, hat kleine Hinterstigmen und ein stark reduziertes Cephalopharyngealskelett. Dabei soll sie Ähnlichkeit mit einer *Physocephala*larve haben und daher vermutlich einer Conopidenart angehören, während *Larva termitovorax* von KEMNER einer Musciden- oder allenfalls Phoridengattung (1925 b S. 157) zugewiesen wird. Auch die Einwirkung auf das Wirtstier ist in beiden Fällen stark verschieden. Der myiagene Soldat SILVESTRIS ist stärker umgemodelt. Er hat zwar die Länge eines grossen Soldaten, sieht aber mehr wie eine besondere, ungewöhnlich grosse Arbeiterform aus, oder genauer wie eine Zwischenform zwischen grossem Arbeiter und grossem Soldaten. Dass er überhaupt ein Soldat und keine umgestaltete Arbeiterform ist, wird von SILVESTRI erst gegen Schluss der Abhandlung klar ausgesprochen mit den Worten (S. 17): „Er wäre ein gewöhnlicher grosser Soldat geworden, hätte das Dipteron nicht in seinen Kopf ein Ei oder eine Larve gelegt, vielleicht am Anfang des letzten Larvenstadiums, das heisst vor Vollendung der letzten Häutung, aus welcher der differenzierte grosse Soldat hervorgegangen wäre." Hieran schliessen sich dann l.c. einige wichtige Bemerkungen über die Ätiologie des Phänomens. „Im Augenblick der Ablage muss das Fliegenei wohl von einer Flüssigkeit begleitet sein, welche die Histolyse grosser Teile der Mandibelmuskeln bewirkt und macht, dass die Entwicklung der Mandibeln auf dem Stadium derjenigen der Arbeiter stehen bleibt, sowie auch, dass der Kopf eine geringere Grösse als beim grossen Soldaten erlangt; anderseits empfängt der Myiagene von den Arbeitern die Verpflegung der Soldaten, und diese Kost bewirkt die Entwicklung der übrigen Organe, näherhin des Thorax, des Hypoderms und des Fettgewebes, ähnlich wie bei den Soldaten". Der Reiz, meint SILVESTRI, könne auch, während sich die Parasitenlarve noch im ersten Stadium befindet, von deren Speicheldrüsensekret ausgehen, auf jeden Fall aber sei er chemischer und nicht mechanischer Natur. Denn einmal habe er in einem typischen Myiagenen mit histolysierten Mandibelmuskeln eine ganz kleine Larve von nur ein Millimeter Länge gesehen. — Diese Bemerkung scheint gegen KEMNER gerichtet zu sein, der in der mechanischen Zerstörung der Kiefermuskeln den ersten Anstoss zur Umbildung erblickt. Auch auf diese Kontroverse wirft das von Dr. KALSHOVEN gesammelte Material ein neues Licht.

2. Die Gattung Misotermes n.g.

C h a r a k t e r i s t i k. Gattung der *Aenigmatiinae*, verhältnismässig grosse Tiere, in beiden Geschlechtern geflügelt. Kopf hoch, kurz und breit, mit ziemlich flacher, rechteckiger Stirn und einer grossen, fast ebenen Gesichtspartie, die von der Vorderkante der Stirn im rechten Winkel nach unten abfällt und zwischen den nach vorn vorstehenden Komplexaugen zurücktritt. Stirn ohne

vertiefte Mittellinie, mit breitem Stemmaticum, drei Ozellen und sehr abgeschwächter, fast ganz auf das Ozellenfeld beschränkter Beborstung. Hauptaugen in beiden Geschlechtern gross, stark gewölbt und mit vielen Fazetten, bei der typischen Art nackt. Fühler beim ♂ grösser als beim ♀, das dritte Glied stark von vorn nach hinten zusammengedrückt, mit dorsaler Arista. Taster kurz, knopfförmig, mit schwacher Beborstung. Mundöffnung klein. Prälabrum stark chitinig, hochgewölbt, mit dem pharyngealen Pumpapparat eine einheitliche Kapsel bildend. Bei der Genotype fehlen Labrum und Hypopharynx, ist das Mentum sehr kurz, die Labellen ziemlich gross, flach und sehr tasterähnlich, ohne Pseudotracheen.

Thorax longitudinal und transversal stark gewölbt, kaum so lang wie breit, mit niedrigen Pleuren und überhaupt von dem der Subfamilie eigenen Bau; Propleuren ganz auf der Thoraxvorderseite gelegen, die Mesopleuren mit dem Postpronotum (Schulterbeule) nahtlos verwachsen, Prothorakalstigmen etwas einwärts der Schulterecke und von oben sichtbar. Scutellum am Hinterrande mit mehr als vier Borsten.

Abdomen breit und niedrig, nach hinten verschmälert, oben fast nackt, mit verlängertem zweiten und sechsten Tergit, Hypopyg klein und verborgen, Terminalia des Weibchens eine lange und dünne, teleskopartig einstülpbare Röhre, also keinen eigentlichen, d.h. hornigen Ovipositor bildend.

Beine von gewöhnlichem Bau. Hinterschenkel nicht besonders stark verbreitert, Schienen ohne Einzelborsten, alle mit dorsaler Längsleiste von Palisadenhaaren, die hintersten vorderseitig mit einer anterodorsalen und anteroventralen Serie kleiner Börstchen.

Flügel bei der typischen Art mit sehr langer, ganz kurz bewimperter Randader und ungegabelter, fein behaarter dritter Längsader. Vierte Längsader sanft S-förmig geschwungen, die siebente deutlich ausgebildet. Schwinger in beiden Geschlechtern vorhanden.

Larve endoparasitisch in Termiten lebend. Sie ist kurz und dick, hat eine stark gewölbte Unterseite, sodass Mund und After hoch über der Mediohorizontallinie liegen. Puparium ein eiförmiges glattes Tönnchen ohne Prothorakalhörner. Typische Art *M. exenterans* von Mittel-Java = *M. exenterans* SCHMITZ, Natuurhist. Maandbl. XXV (1936) 77 nom. nud.

V e r g l e i c h m i t a n d e r n G a t t u n g e n. Wie bei *Euryphora* SCHMITZ und *Microplatyphora* SCHMITZ ist bei der neuen Gattung das Weibchen dem Männchen ähnlich und zeigt nicht den für ein Dipteron so ungemein fremdartigen, asselartigen Körperbau der Weibchen der übrigen *Aenigmatiinae*. Sehen wir hiervon ab, so finden wir eine Anzahl der *Misotermes*merkmale bei den übrigen Gattungen wieder. Die kurze Stirn mit dem senkrecht abfallenden, langen Gesicht tritt allerdings nirgends auf. *Aenigmatistes* würde hier einigermassen zum Vergleich herangezogen werden können, wäre nicht bei dieser afrikanischen Gattung die Oberstirn sehr stark transversal gewölbt und unterhalb der Stirnvorderkante eine kräftig chitinisierte halbkreisförmige Stutzfläche ausgebildet, an die sich nach unten zu erst die Fühlergruben anschliessen. Wir haben diese

Stutzfläche bisher zur Stirn gerechnet und als Unterstirn bezeichnet; es ist aber möglich, dass sie vergleichend morphologisch zur Praefrons (sensu Hendel) gehört und eine eigenartige Differenzierung des obern Teiles des Gesichts darstellt. *Misotermes* legt diesen Gedanken nahe, da auch bei ihm der oberste Teil des Gesichts insofern differenziert ist, als hier eine sonst nie bei Phoriden beobachtete Behaarung auftritt.

Die abgeschwächte und unregelmässige Stirnbeborstung, die Fühler- und Tasterbildung von *Misotermes* sind bereits von andern Gattungen her im Prinzip bekannt, auch die Schienenbörstchen z. B. bei *Aenigmatistes* ♂. Ob es zu den eigenartigen Mundteilen von *Misotermes* eine Parallele gibt, lässt sich schwer feststellen; von mehreren Gattungen wird ausdrücklich erwähnt, dass sie eine Oberlippe und Pseutracheen am Labium besitzen, doch auch das Fehlen von Pseudotracheen wurde gelegentlich schon festgestellt, z. B. von mir bei *Aenigmatias* (Schmitz 1915, 471). Wie bei den Phoriden überhaupt, sind auch innerhalb der Unterfamilie *Aenigmatiinae* die Mundteile ziemlich variabel. Bei *Psylomyia* und *Assmutherium* kommt sogar ein verlängerter, geknieter Rüssel vor.

3. Misotermes exenterans n.sp.

Männchen. — Kopf (Pl. 5 Abb. 1; Abb. 2) fast so breit wie der Thorax an seiner breitesten Stelle. Stirn etwa doppelt so breit wie lang, annähernd rechteckig, doch nach vorn etwas breiter werdend, transversal sehr wenig gewölbt, schwarz mit geringem Glanz. Scheitelrand hinter dem breiten Ozellenfeld geschärft, auswärts davon jederseits etwas eingekerbt. Stirnvorderrand nicht scharfkantig, vorn mitten nicht vorgezogen, die Grenzgegend von Stirn und Gesicht fein behaart. Ozellenfeld quer rechteckig, halbsolang wie die Stirnmediane, wenig erhaben, hinter dem vordern Ozellus und vor dem ansteigenden Scheitelrand etwas eingedrückt, Ozellen gut entwickelt und fast in gerader Querlinie. Feinbehaarung ausser am Vorderrand sehr spärlich. An Stelle normaler Stirnborsten sieht man auf dem Ozellenfeld längs des Hinterrandes und einwärts von den Hinterozellen lange schwarze und steife Haare; ein solches vertritt auch am Seitenrande die vordere oder mittlere Laterale. Hauptaugen stark gewölbt, die ganze Kopfseite einnehmend, viel höher als breit, unten dem Mundfeld sich nähernd, Fazetten zahlreich, entsprechend Abb. 2. Postocularcilien schwach, die oberste und unterste wenig differenziert. Hinterkopf nicht stark ausgehöhlt, sondern mehr wie bei normalen Phoriden, also seine Oberhälfte schwach konkav, die Unterhälfte mehr konvex. Die bei mehreren andern Gattungen der Unterfamilie vorhandene, vom Mundrand zum untern vordern Augenrand hinziehende Borstenreihe fehlt. Statt Fühlergruben zu bilden, ist die ganze Gesichtspartie zwischen den vorquellenden Augenvorderhälften eingesenkt und bildet ein fast quadratisches, nahezu ebenes Feld, das oben abgerundet rechtwinklig in die viel kürzere Stirn übergeht. Fühler sehr gross, das Gesicht grösstenteils bedeckend, braunrot; erstes Glied von vorn gesehen rechteckig, zweites verborgen, drittes stark von vorn nach

hinten zusammengedrückt, fast schaufelartig, mit konvexer Vorder- und etwas konkaver Rückseite, deren Flächen in einem scharfen Rande zusammenstossen; breiter als lang, annähernd nierenförmig im Umriss, am Rande öfters verdunkelt. Arista dorsal, recht lang (ca 1 mm), fein und weitläufig pubeszent, Basalglieder nicht verdickt. Taster kurz, länglich knopfförmig, braunrot mit einigen unbedeutenden Börstchen. Zwischen den Tastern ragt bulbusartig ein schwarzglänzendes Prälabrum vor, wie man es gewöhnlich bei Phoriden mit verlängertem geknietem Rüssel sieht, während hier der Rüssel rudimentär ausgebildet ist.

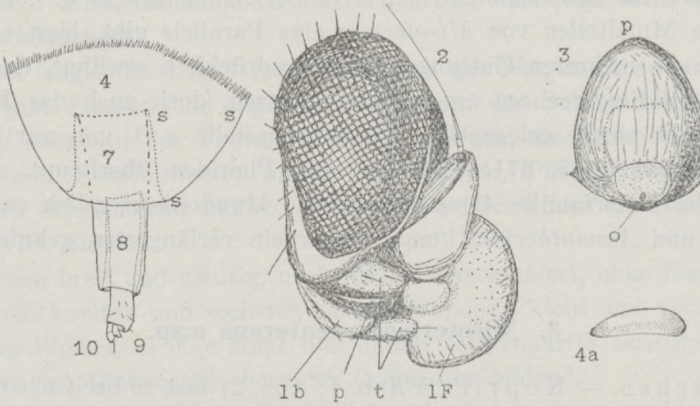

Abb. 2 - 4. *Misotermes exenterans*: 2 Kopf ♂ Profil (lb Labellen, lF linker Fühler, p Prälabrum, t Taster); 3 ♀ Fultrum von vorn (p Prälabrum, o Oberlippe); 4 ♀ Terminalia, von rechts (sss häutiger Saum des 6. Abdominalsegments, 7 - 10 siebentes bis zehntes Abdominalsegment); 4a Ei von *Misotermes exenterans*.

Jener Bulbus, das sog. Fulcrum, ist beim ♂ etwas kleiner als beim ♀ und stellt eine eiförmige, ringsum chitinisierte Kapsel dar, die durch Verschmelzung von Clypeus und Pharynx entsteht. Wie Abb. 3 zeigt, hat die Kapsel eine grössere Öffnung in der Hinterwand zum Austritt des Oesophagus und eine kleine in der Vorderwand zum Ansatz des Rüssels. Die Kapsel ist zwar nicht ganz starr mit dem Kopfskelett verbunden, aber doch wenig beweglich, ähnlich wie ich es von *Euryphora madagascarensis* beschrieben habe (1915 S. 490). In ihrem Innern sieht man die Pumpmuskeln und vorn am Grunde des Ausschnitts (vgl. Abb. 3 o) ein winziges, sklerotisiertes Gebilde, das vielleicht ein ganz rudimentäres Labrum (Oberlippe) darstellt. Ein frei vorragender Hypopharynx fehlt. Das Labium besteht aus einem kurzen weichhäutigen Mentum und den bis auf den Grund von einander getrennten Labellen. Diese haben den aus Pl. 5. Abb. 5. ersichtlichen Umriss, sind abgeflacht, unten weichhäutig, während die Oberseite ein sehr zierliches Netzwerk von anastomisierenden erhabenen Chitinleisten trägt. Am Aussenrand einige Börstchen, Pseudotracheen fehlen. Im Ganzen genommen macht der Rüssel den Eindruck, als sei er in seiner Funktion sehr beschränkt.

T h o r a x schwarz, glänzend, mit schwarzer Pubeszenz in feinen, eingestochenen Punkten. Rücken an der breitesten Stelle ganz wenig breiter als in der Mittellinie lang, wenn das Schildchen hinzugerechnet wird; die grösste Breite ist

gleich der grössten Thoraxhöhe, die Brusthöhe von der Mittellinie des Mesosternums bis zur Notopleuralnaht gemessen beträgt nur 7/12 der gesamten Thoraxhöhe. Am Seitenrande des Notums einige borstlich entwickelte Haare. Vorn mitten erhebt sich die Rückenvorderkante zu einem kleinen Höcker, dergleichen bisher bei Phoriden noch nicht beobachtet wurde. Schildchen bräunlich, kurz und breit, fast rechteckig, da der Hinterrand kaum konvex ist, mit einer Reihe von aufrecht stehenden und z. T. etwas gekrümmten Haaren, jederseits der Mitte etwa 7. Die schwärzlichen Mesopleuren nackt, ausser vorn oben, wo sie in den Rücken übergehen. Prothorakalstigmen etwas oval. Pteropleuren und Postalargegend heller.

Abdomen oben schwarzbraun, matt, der erste Ring hinten breit weiss gesäumt, auch die übrigen mit feinem hellen Hintersaum, Tergit 2 und 6 verlängert, 3 - 5 untereinander gleichlang, alle sehr schwach behaart, die Hinterrandhaare nicht differenziert. Die Seitenteile der Tergite bauchwärts umgeschlagen und fast nackt, ebenso der etwas heller gefärbte Bauch. Hypopyg recht klein, im sechsten Abdominalsegment verborgen, sodass nur der Analtubus hervorragt, symmetrisch gebaut, ganz gelb. Oberteil sehr kurz und hoch, nach unten zu etwas breiter werdend, mit einwärts gekrümmten Unterrand, in dieser Gegend behaart. Unterteil basal jederseits kissenförmig vorspringend, auffallend symmetrisch. Analtubus fast dreimal länger als der Oberteil, kompress, im Profil rechteckig, Ventrit und Tergit gleichlang. Endhaare nich deutlich differenziert.

Beine gelb, besonders auch die Vorderhüften, ohne auffallende Merkmale. Alle Tarsenglieder länger als breit, der Prätarsus überall gut entwickelt. Hinterschenkel wenig verbreitert, doch nicht so schmal wie bei *Aenigmatistes* ♂, Hinterschienen gegen Ende etwas breiter werdend, die vorderseitigen Börstchenserien lückenhaft unregelmässig, mitunter streckenweise doppelt.

Flügel mit ungetrübter Membran, ähnlich wie beim ♀ (Pl. 5. Abb. 6), aber etwas kürzer und breiter, Vorderrandadern hellbraun, die andern farblos aber deutlich. Randader sehr lang (etwa 0.63), mit zahlreichen sehr kurzen Wimpern in zwei Reihen, Abschnitts-verhältnis 19 : 11. Dritte Längsader fein behaart, vierte sanft S-förmig hin und her gebogen, sechste stark geschwungen, die siebente bis zum Rande deutlich.

Schwinger gelb. Körperlänge gegen 3 mm.

Weibchen — Dem ♂ sehr ähnlich, mit folgenden Unterschieden: Kopf deutlich weniger breit als die maximale Thoraxbreite. Fühler viel kleiner als ♂, das dritte Glied linsenförmig, nur sehr wenig breiter als hoch. Die Labellen sind vorgestreckt und reichen ebensoweit nach vorn wie der Bulbus des Prälabrums. Bauch durchweg dunkler als ♂. Die Terminalia sind gelb und bilden eine lange, dünne, ausstülpbare Röhre, die aber teleskopartig so sehr verkürzt werden kann, dass ihr Hinterende weniger nach hinten vorsteht als der Analtubus des ♂. Dies wird dadurch erreicht, dass das 6. Abdominalsegment des ♀ hinten einen langen gelben Saum hat, der aus- und eingestülpt werden kann (Abb. 4. s). Bei seiner Einstülpung verschwindet der ganze Legeapparat im Hin-

terleibsinnern, indem gleichzeitig das 9. Segment ins 8., dieses ins 7. zurückgezogen wird. Vollständig evaginiert beträgt die Terminalialänge etwa 1.6 mm. Deutlich sklerotisierte Tergit- und Ventritplatten kann ich an den Terminalia nicht wahrnehmen, daher ist auch die Dorsalgrenze von Segment 9 und 10 verschwommen. Abgegliederte Cerci sind nicht vorhanden.

Wie Bauch und Flügel, so sind auch die Beine beim ♀ stets etwas dunkler als beim ♂, mit Ausnahme der vordern m.o.w. verdunkelt gelbbraun. Hinterschenkel etwas schlanker.

An den etwas gelbbraun getrübten Flügeln (Pl. 5. Abb. 6) ist die Randader von derselben relativen Länge wie ♂, der erste Abschnitt kann relativ ein wenig länger sein, doch ist er auch wohl beim ♂ variabel. Regelmässig aber ist die vierte Längsader ♀ in der distalen Hälfte fast gerade, nicht nach vorn konvex. Siebente Längsader den Rand nicht erreichend.

Körperlänge 3 - 3½ mm.

Nach etwa 20 Exemplaren ♂ ♀ beschrieben, Holotype ♂ in meiner Sammlung. Djatiwald im südlichen Mitteljava, S von Semarang, bei Telawa.

Die vorimaginalen Zustände.

Ei.

Abgelegte Eier in gut konserviertem Zustand habe ich nicht untersuchen können; sie werden im Beitrag von Dr. KALSHOVEN beschrieben (s. unten) und sollen 0.85 - 0.95 mm lang sein.

Die Anzahl der Eier ist sehr gross. Im Abdomen eines trächtigen Weibchens fand ich 751, bei andern waren es weniger, vielleicht weil ein Teil schon abgelegt war. Die Ovarialeier sind 0.36 - 0.40 mm lang, etwa viermal länger als breit, nach beiden Enden verschmälert, dabei an einem Pol zugespitzt. Sie scheinen ein starkes Chorion zu besitzen, da sie das Zerzupfen des Eierstock gut vertrugen und sich dabei aus den Kammern lösten. Die Eier werden mit dem stumpfen Pol voran abgelegt, wie ich an einem ♀ mit einem Ei am Ende der Legeröhre bemerkte.

Dieses — allerdings, wie auch die vorhin erwähnten Eier, vollständig vertrocknete Gebilde — ist 0.38 mm lang und 0.12 mm breit. Abbildung 4a ist die von Dr. KALSHOVEN eingesandte Skizze eines abgelegten Eies.

Larve.

KEMNER und SILVESTRI sprachen beide die Vermutung aus, dass die von ihnen in myiagenen Soldaten beobachteten Dipterenlarven bereits in den Larven dieser Soldaten vorhanden gewesen sein müssen. Bei *Misotermes exenterans* ist dies in der Tat der Fall. Dr. KALSHOVEN sandte mir eine grosse Menge von Soldatenlarven aus einem durch hohen Prozentsatz von Myiagenen ausgezeichneten Termitennest, und in fast allen diesen Soldatenlarven fand ich im Kopfe

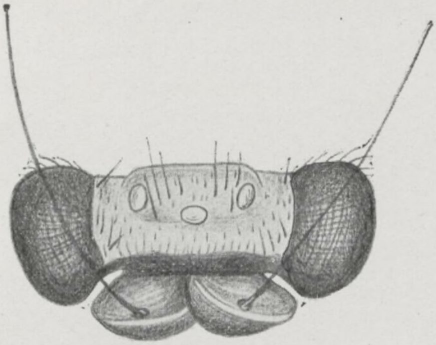

Abb. 1. *Misotermes exenterans* ♂, Kopf von oben.

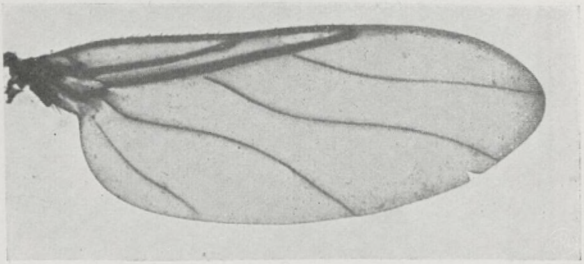

Abb. 6. *Misotermes exenterans* ♀, Flügel. Mikrophot.

Abb. 5. *Misotermes exenterans*, linke Labelle von oben. Mikrophot.

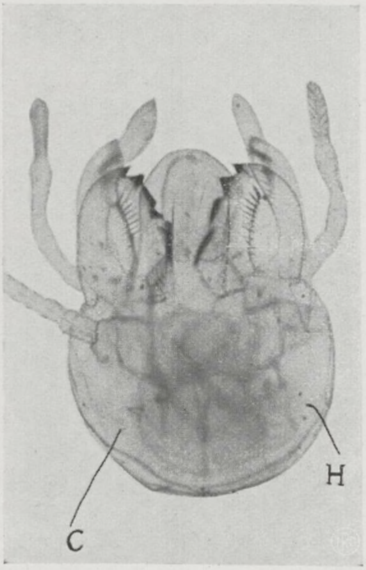

Abb. 19. *Macrotermes gilvus*, Kopf der vorletzten Soldatenlarve mit Koplarve (C Cephalopharyngealskelett und H Hinterstigmen der *Misotermes*larve). Mikrophot.

den Parasiten. Seine Auffindung wird sehr erleichtert durch das dunkle Schlundgerüst (Abb. 8, 11), das bei 70 × binokularer Vergrösserung irgendwo zwischen den Kopfeingeweiden der Termitenlarve auftaucht und die Anwesenheit der Dipterenlarve sofort verrät. Auch deren Analstigmen werden leicht sichtbar

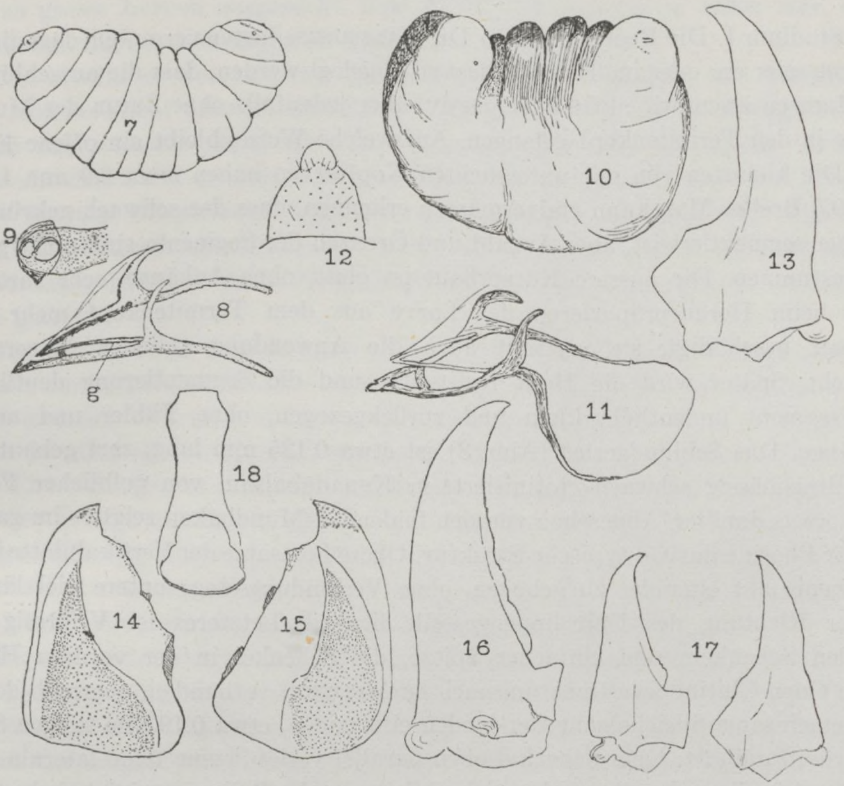

Abb. 7 - 11. *Misotermes*larve I und II, 12 - 18 Soldat von *Macrotermes gilvus*. 7 Junge Larve des II. Stadiums von links; 8 Schlundgerüst des ersten Stadiums (g laterale Chitingräte); 9 Analstigma des ersten und zweiten Stadiums; 10 Ausgewachsene Larve des zweiten Stadiums von rechts; 12 Oberlippe des Myiagenen; 13 Rechte Mandibel des normalen Soldaten; 14, 15 Mandibeln der letzten Larve des Myiagenen; 16 Linke Mandibel des normalen Soldaten; 17 Mandibelpaar des Myiagenen; 18 Gula desselben.

Abb. 9, Pl. 5. Abb. 19). Die Termiten müssen vorher in ein stark aufhellendes Medium gebracht werden.

Bei Phoridenlarven gibt es drei durch zwei Häutungen getrennte Stadien, die sich ausser durch die Grösse gewöhnlich auch morphologisch unterscheiden. So ist es auch bei *Misotermes*. Zwei morphologisch verschiedene Larventypen sind ohne weiteres zu erkennen, die jüngeren Larven im Kopf und die erwachsenen im Abdomen des Wirts, nennen wir sie kurz Koplarven bzw. Abdominallarven. Der auffallenste äussere Unterschied liegt, abgesehen von der Grösse, in der Ausbildung der Stigmen. Bei den Kopflarven (Stadium I und II) scheinen Vorderstigmen zu fehlen; ich konnte sie trotz aller Anstrengungen nicht finden. Ihre Hinterstigmen sind klein, einfach und von einander getrennt. Die

Abdominallarven dagegen (Stadium III) haben deutliche Vorderstigmen und grosse, auf einer gemeinsamen chitinigen Platte vereinigte Hinterstigmen (Abb. 23).

Die Kopflarven.

Stadium I. Die Beobachtungen Dr. KALSHOVENS lassen vermuten, dass die *Misotermes*eier am oder im Termitennest so abgelegt werden, dass die ausschlüpfenden Larven irgendwie aktiv oder passiv, aber jedenfalls ohne Zutun des Muttertieres in den Termitenkopf gelangen. Auf welche Weise, bleibt ein offene Frage.

Die kleinsten von mir untersuchten Kopflarven haben etwa 0.9 mm Länge und 0.5 Breite. Man kann einigermassen erkennen, dass der schwach gekrümmte Körper segmentiert ist, aber Anzahl und Grenzen der Segmente sind nicht genau zu bestimmen. Die äussere Körperhaut ist glatt, ohne Anhänge, sehr zart und wird beim Herauspräparieren der Larve aus dem Termitenkopf mehr oder weniger beschädigt, sie verträgt auch die Anwendung gelinder Macerantia schlecht. Später wird die Haut resistenter und die Segmentierung deutlicher. Kopfsegment undeutlich, klein und zurückgezogen, ohne Fühler und andere Anhänge. Das Schlundgerüst (Abb. 8) ist etwa 0.125 mm lang, zart gebaut und verhältnismässig schwach chitinisiert, in Kanadabalsam von gelblicher Farbe, vorn etwas dunkler. Abgesehen von den fehlenden Mundhaken zeigt es im ganzen die für Phoridenlarven typische Struktur. Obere Fortsätze der Vertikalplatte kurz, nur wenig auf einander zu gebogen, ohne Verbindungssteg; untere viel länger, in der Richtung des Unterlippengestells liegend. Letzteres ist V-förmig mit geraden Schenkeln und einfacher Spitze, die Schenkel in der vordern Hälfte durch einen Chitinbogen (mentum nach DE MEIJERE) verbunden, oberhalb dessen der gemeinsame Speichelgang der beiden eiförmigen, etwa 0.19 mm langen Speicheldrüsen mündet. Dem Schenkel oben parallel verläuft eine feine laterale Chitingräte (g), die sich mit der der andern Seite an der Spitze vereinigt und so das etwas kürzere, ebenfalls V-förmige-Oberlippengestell bildet. Wie zu erwarten fehlen dem Pharynxboden die bei nichtparasitischen Larven vorhanden Längsrillen. Hinterstigmen (Abb. 9) klein, weit von einander getrennt, mit zwei annähernd kreisförmigen Öffnungen von je 0.01 mm Durchmesser. Peritrema schirmartig gewölbt.

Wirt des Stadiums I. Die bisherigen Beobachtungen führen zu der Annahme, dass *Misotermes* ein ausschliesslicher Parasit der Soldatenkaste sei. Das mir vorliegende Material enthält keine Arbeiter und Geschlechtstiere, sodass nicht geprüft werden konnte, ob sich *Misotermes*larven niemals in Angehörige dieser Kasten „verirren". Wegen der geringen Grösse der Termitenarbeiter ist es von vornherein unwahrscheinlich, dass sich *Misotermes* in ihnen voll zu entwickeln vermag.

In welches Stadium der Soldatenlarven dringt nun *Misotermes* ein? Bisher wurde vermutet: in das letzte. Ich kann nicht nachweisen, dass der Parasit regelmässig schon ein früheres Stadium befällt. Aber in einem Falle fand ich eine junge *Misotermes*-larve schon in der vorletzten Soldatenlarve, Pl. 5. Abb. 19.

Diese Larve war die kleinste von allen, die ich überhaupt zur Untersuchung erhielt und ist veilleicht nur durch einen glücklichen Zufall mitgesandt worden; alle oder fast alle andern waren merklich grösser (6.5 - 8 mm) und repräsentieren tatsächlich das letzte Larvenstadium. Herr Dr. KALSHOVEN hat mit Absicht so grosse Larven ausgesucht, weil er nur bei ihnen ganz sicher war, dass es sich um Larven von Soldaten handle.

Die erwähnte vorletzte Soldatenlarve hat ungefähr die Mandibeln eines Arbeiters und könnte oberflächlich betrachtet mit einem unausgefärbten solchen verwechselt werden, aber die Masse der einzelnen Körperteile stimmen weder mit denen des grossen noch mit denen des kleinen Arbeiters bei KEMNER (1934) überein. Körperlänge 5.025 mm, grösste Breite des Abdomens 1.65 mm, Prothorax 0.874 mm, Metathorax 1.14 mm, Kopf 1.36 mm breit, linke Mandibel 0.7 mm lang, 0,47 mm breit, Fühler 17-gliedrig. Farbe weiss, nur die Mandibelzähne gelbrot.

Von der letzten Soldatenlarve liegen mir zahlreiche Exemplare vor, die fast alle im Kopf eine *Misotermes*larve beherbergen, in der Grösse etwas variieren und zum Teil nahe vor der letzten Häutung stehen. Bei fast allen sind die Fühler 17-gliedrig, nur einmal 18-gliedrig. Körperlänge 6.1 - 8 mm. Pronotum 1.39 - 1.61, Metanotum 1.6 - 1.9, Kopfbreite 1.8 - 2.2 mm. Die Mandibeln sind schmaler geworden und die Zähne ihres Innenrandes obsolet, bald mehr bald weniger (Abb. 14, 15), auch ihre Färbung ist blässer. Larven, die der Häutung näher stehen, zeigen schon deutlich die Umrisse der künftigen Mandibel des Myiagenen innerhalb der eigenen Mandibel (Abb. 14, 15).

Beeinflussung des Wirtes durch das Stadium I des Parasiten. Wir sahen in der Einleitung, dass SILVESTRI glaubt, die Ablage der vermeintlichen „Conopideneier" bei *Macrotermes gilvus* von den Philippinen sei mit der Einspritzung einer Flüssigkeit verbunden, die im Kopf des Wirtes histolytische Wirkungen hervorbringe, oder solche könnten vielleicht auch vom Speicheldrüsensekret der jungen „Conopiden"-Larve ausgehen.

Für *Misotermes exenterans* trifft weder das eine noch das andere zu. Die erste Alternative ist ausgeschlossen, weil das Muttertier seine Eier nicht unmittelbar in den Termitenkopf ablegt; die zweite deshalb, weil von irgendwelcher Histolyse im Kopf der Soldatenlarve bei meinem Objekt nichts zu bemerken ist. Alle Kopfeingeweide sind vorzüglich erhalten, und ihre gut färbbaren zytologischen Einzelheiten können an Serienschnitten, deren ich mehrere anfertigte, genau studiert werden. Die *Misotermes*larve liegt im hintern Teil des Kopfes bald in der Mitte, bald mehr nach rechts oder links und ist zwischen der Kopfmuskulatur des Wirtes bisweilen stark eingeklemmt. Sie lebt offenbar von der Blutflüssigkeit des Wirts. Ihr Mitteldarm ist prall mit einer strukturlosen Masse gefüllt, die wie mir scheint, nichts anderes als Termitenblut sein kann. Dieses wird sicher grossenteils assimiliert, denn der Enddarm des Parasiten ist fast leer und auf der letzten Strecke vor dem sehr kleinen After recht schmal mit einem engen Lumen. Die aufgenommenen Nährstoffe werden zum geringen Teil im Fettgewebe, das nicht besonders entwickelt ist, sondern hauptsächlich in der

eigenen Blutflüssigkeit des Wirts gespeichert, welche aussergewöhnlich konzentriert ist und bei fixierten Objekten in koaguliertem Zustande die ganze Leibeshöhle ausfüllt (Pl. 6 Abb. 20).

Als Beweis für die Histolyse führt SILVESTRI die Beobachtung an, dass die Kopfmuskulatur von myiagenen Soldaten in mehreren Fällen schon stark geschwunden war, obwohl die Larve des Parasiten noch sehr klein war. Unterstützt wird dieser Beweis von SILVESTRIS Fig. VIII 1: „Kopf eines *Myiagenen*, durchscheinend sieht man eine junge *'Conopiden'*-larve, das Supraoesophagealganglion und die wenigen noch vorhandenen Mandibelmuskeln". Aber dieser Beweis scheint mir nicht bündig. SILVESTRI vermutet ja selbst (Seite 17), dass die ersten Stadien des von ihm beobachteten Parasiten schon in der letzten Larve des Myiagenen vorhanden gewesen seien. Es müsste also gezeigt werden, dass bei dieser Larve die Kopfweichteile histologisch verändert sind. Das hat S. nicht bewiesen, die Larven seiner Myiagenen scheint er überhaupt nicht untersucht zu haben.

Bei *Misotermes exenterans*-Larven bis zu 1.2 mm Länge beobachtet man im Kopf der befallenen Soldatenlarven jedenfalls keine anatomischen Veränderungen. Vielleicht treten solche gegen Ende dieses Larvenstadiums auf. Beim frisch entwickelten Myiagenen sind sie unverkennbar, doch nicht so stark wie in SILVESTRIS Fig. VIII 1 und 2.

Übrigens bin ich fest überzeugt, dass die angebliche Conopidenlarve SILVESTRIS in Wirklichkeit auch eine *Misotermes*larve ist. Die Struktur des Schlundgerüstes, das Fehlen der Vorderstigmen und der gleiche Bau der Hinterstigmen sind ganz frappante Aehnlichkeiten, und sie steigern sich noch im zweiten Stadium meiner *Misotermes*larve, wie wir sehen werden. Das zweite Stadium seiner Larve hat S. für das erwachsene gehalten, offenbar weil er im Kopf seiner Myiagenen kein weiteres Stadium fand. In Wahrheit wird sich gewiss auch bei der philippinischen Art das erwachsene dritte Stadium im Hinterleib der Myiagenen finden!

Entscheidend für die Entstehung der Myiagenen von *Macrotermes gilvus* sind vermutlich weder mechanische Verletzung noch Histolyse, sondern neben ungenügender Durchblutung des Kopfes irgendwelche andern Reize, die mit dem Vorhandensein der jungen *Misotermes*larve im Kopf der vorletzten und letzten Soldatenlarve gegeben sind. Ihre Natur näher zu bestimmen, wird wohl so leicht nicht gelingen. Am besten fasst man den verkürzten, aufgetriebenen Kopf samt der gehemmten Entwicklung der Kiefer und den übrigen kennzeichnenden Merkmalen der Myiagenen als eine Art animalischer Gallenbildung auf, wie KEMNER es gelegentlich andeutet.

Stadium II (Abb. 7, 10). Die Larve des ersten Stadiums findet man nicht bloss in der vorletzten, sondern auch in der letzten Soldatenlarve. In ihr findet, wie es scheint, die erste Häutung statt; wenigstens sah ich einmal im Kopf einer solchen Soldatenlarve ausser einer schon etwas grösseren *Misotermes*larve ein verstummeltes Schlundgerüst nebst einem andern Fremdkörper, anscheinend der Exuvie von Larve I. Welche Länge diese vor der Häutung erreicht, vermag

ich nicht genau anzugeben; die Untersuchung dieses Punktes ist recht schwierig. Die grösste von mir in einer Soldatenlarve gefundene *Misotermes*larve mass in stark gekrümmter Haltung 1.6 mm. Eine Larve von annähernd dieser Länge fand ich auch im frisch entwickelten, noch weiss gefärbten Myiagenen. Larven dieser Grösse sind immer schon im Stadium II.

Abb. 7 zeigt eine junge Larve II von 1.4 mm Länge von der linken Seite. Der Vorderkörper, insbesondere vom ersten bis zum vierten Abdominalsegment, ist etwas dicker als der Hinterkörper, wie im spätern Stadium III.

Die ausgewachsene Larve II (Abb. 10) verhält sich ganz ähnlich wie es Silvestri von seiner „ausgewachsenen" Larve beschrieben und l.c. S. 15 in seiner Fig. VII 3 - 10 abgebildet hat.

Um in der Kopfkapsel des Myiagenen Platz zu finden, ist sie zunächst stark U-förmig gekrümmt, sodass Vorder- und Hinterende einander genähert werden; die konvexe Seite ist die ventrale. Bei der Enge des Raumes genügt aber die blosse Krümmung noch nicht; hinzutritt eine starke Abplattung derjenigen Seite des Larvenkörpers, welche der Dorsalseite des Termitenkopfes von innen anliegt. In Abb. ist dies die linke, vom Beschauer abgewandte Seite. Diese Seite erscheint bei Oberansicht wie ein gleichmässig gewölbter Schild, an dem die Segmentgrenzen infolge der starken Pressung bis zur Unkenntlichkeit verwischt sind. Die der ventralen Wand des Termitenkopfes anliegende Seite des Larvenkörpers (Abb. 10) ist weniger gepresst und oben in der Mitte etwas konkav, sodass die Segmentierung deutlicher hervortritt. Die abgebildete Larve ist vom linken zum rechten Rande gemessen 3 mm lang.

Die Hinterstigmen der Larve II sind nicht grösser als im Stadium I und haben den gleichen Bau. Auch beim Schlundgerüst (Abb. 11) hat die absolute Grösse nicht zugenommen, aber die Form hat sich etwas geändert. Die Vertikalplatten samt dem obern Fortsatz sind stark aufeinander zu gebogen und scheinen, von vorn gesehen, den Pharynx ringförmig zu umgeben. Die untern Fortsätze sind entschieden abwärts gebogen, divergieren mehr und lassen nach hinten zu den Boden der Pharynxhöhle als hinten abgerundete Platte deutlicher hervortreten. Ober- und Unterlippengestell klaffen wie ein aufgesperrter Vogelschnabel auseinander.

P a t h o l o g i s c h e E i n w i r k u n g e n a u f d e n K o p f d e s W i r t e s. Von fertigen Myiagenen liegt mir ein ziemlich beschränktes Material vor, weshalb nur Beobachtungen aphoristischen Charakters angestellt werden konnten. Im Kopfe eines frisch entwickelten Myiagenen fand ich die Fliegenlarve im obern hintern Teil in dem Raum zwischen den beiden grossen Sehnen der Mandibeladduktoren, in einer Höhlung, die durch das Fehlen der an der medialen Seite inserierenden Muskelbündel entsteht. Das Gehirn ist nach vorn gedrängt und im Umfang verkleinert; der Oesophagus schien mir normal. Die Myiagenen werden also in diesem Stadium noch Nahrung zu sich nehmen und die Kiefer bewegen können, wenn auch mit geringerer Kraft. Es ist zu vermuten, dass auch zu dieser Zeit die Phoridenlarve nur von der Blutflüssigkeit des Wirtes lebt, und dass dessen Kopfeingeweide nur durch Unterernährung und Raumbe-

schränkung allmählich atrophieren. Je mehr die Larve II wächst, um so stärker werden die beiden grossen Muskelsehnen auseinander gedrängt, bis sie schliesslich ganz an die Seitenwand der Kopfkapsel gepresst sind. Nach aussen sind sie auch dann noch mit der Kopfdecke durch Muskelfibrillen verbunden, die schliesslich so dünn und fein aussehn wie die Strahlen einer Feder.

Nach Auswanderung der Kopflarve ist daher der Kopf zwar leer, wie die Beobachter immer betonen, jedoch nicht in ganz buchstäblichem Sinn. Ausser den Chitinsehnen sieht man immer den Oesophagus bzw. seine persistierende chitinöse Intima, öfters auch die zwei vom Halse her eintretenden Haupttracheen mit ihren gröberen Verästelungen, dünne Lagen degenerierten Gewebes u. dgl. Einmal traf ich auch den hintern Teil einer Larvenexuvie mit den gut kenntlichen kleinen getrennten Hinterstigmen; vermutlich häutet sich also die Larve II, ehe sie in den Hinterleib des Myiagenen eindringt. Mitunter trifft man auch im Kopf einige lose rundliche Konkretionen von 0.22 - 0.35 mm Durchmesser, mässig spröde, schwach gelblich gefärbt. Sie brausen mit HCl nicht auf und dürften organischer Natur sein, vielleicht Fäces der Fliegenlarve. Ähnliche Krümel liegen auch oft im Thorax des Myiagenen und seiner Larve.

Die Abdominallarve.

Stadium III (Abb. 21). Die dem Abdomen des Myiagenen entnommene erwachsene Larve des dritten Stadiums ist 4½ - 5 mm lang und 2½ - 3 mm breit, etwas weniger hoch als im Maximum breit. Sie ist abgesehen von der rotbraunen, zuletzt ganz dunkeln analen Stigmenplatte ebenmässig weiss gefärbt. Vorderhälfte des Körpers breiter als die Hinterhälfte, Bauchseite stark gekrümmt, dagegen die Rückenseite in der Gegend des 3. bis 7. Abdominalsegments etwas konkav. Man ist daher beim ersten Anblick versucht, die Bauchseite für die Dorsalseite zu halten und umgekehrt. Analstigmen und Mundöffnung hoch über der Mediohorizontallinie gelegen. Integument ohne alle äusseren Anhänge, auch ohne jede Andeutung von Kriechsohlen u. dgl. Die Segmentierung (3 Thorakal-, 8 Abdominalsegmente) tritt trotzdem durch fein vertiefte Grenzlinien genügend hervor, lässt sich aber am Puparium besser studieren und wird dort besprochen werden. Die ersten 5 - 6 Abdominalsegmente zeigen dorsal eine seichte Querfurche, wodurch sie in einen vordern und hintern Abschnitt geteilt sind. Lateral sieht man an den ersten sieben Hinterleibsringen ebensoviele schwache Beulen, die bauchwärts von Furchen und Grübchen begrenzt werden. Am Puparium sind diese Reliefbildungen verschwunden. Bei der reifen Larve

Abb. 21. *Misotermes exscenterans*, erwachsene Larve des III. Stadiums von rechts.

erkennt man auch schon die präformierten Sprengungsnähte der vorn am künftigen Puparium sich ablösenden Teile.

Das Kopfsegment ist wie in den vorhergehenden Stadien derartig rudimentär, dass es als fehlend bezeichnet werden kann. Es gibt denn auch am Vorderende des Körpers keine Partie, die bei der Bildung des Pupariums eingezogen würde; es gibt keine Längsfalte, kein Antennalorgan, keine circumoralen Chitinplättchen oder Haare, es gibt nur eine winzige Mundöffnung, aus der die vorderste Spitze des Schlundgerüstes eben hervorragt. Auch dieses ist im dritten Stadium noch rudimentärer geworden (Abb. 22): die Länge ist zwar unverändert geblieben (0.125 mm), aber von der Vertikalplatte mit ihren beiden Fortsätzen ist nur der untere Fortsatz erhalten, ein kleiner dreieckiger Dorn deutet die verschwundenen Teile an (nur bei seitlicher Betrachtung sichtbar). Die laterale Chitingräte ist mit der der andern Seite und dem kurzen Unterlippengestell ausser an der Vorderspitze chitinig verbunden, sodass das Vorderende des Cephalopharyngealskeletts nun ein kurzes, in eine kleinere obere und eine grössere untere Spitze ausgezogenes Röhrchen darstellt. Die neu auftretenden Prothorakalstigmen (Abb. 22) sind 0.1 mm gross und zeigen mehrere, eine kleine Traube bildende Knospen, die nach aussen von einem Chitinhalbring umgeben sind.

Abb. 22. ***Misotermes exenterans*, Vorderende der erwachsenen Larve III von unten gesehen, mit Schlundgerüst und Prothorakalstigmen.**

Die gegen früher sehr vergrösserten Analstigmen zeigen an, dass die Respirationsverhältnisse sich in diesem Stadium wesentlich verändert haben. Die Stigmen erheben sich als niedrige, abgestumpfte Kegel auf einer gemeinsammen Chitinplatte (Abb. 23), die 0.8 mm breit und in der Mitte 0.27 mm lang ist. Die Vorhofspforten bilden eine um die fast zentral gelegene Stigmennarbe gruppierte Rosette von V- oder Y förmigen Schlitzen.

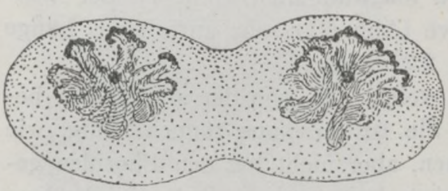

Abb. 23. ***Misotermes exenterans*, Analstigmenplatte der Larve III.**

V e r h a l t e n d e r L a r v e i m S t a d i u m III. Nach der letzten Häutung (vgl. oben) zwängt sich die Larve mit dem Kopfende nach vorne durch das Hinterhauptsloch des Myiagenen und wandert durch den Thorax in den Hinterleib des Wirtes, die Bauchseite nach unten kehrend und die Weichteile des Termitenleibes vor sich hertreibend. Was davon nicht aufgesogen wird, sammelt sich als formlose Masse vor dem Kopfende der Larve in der hinteren Gegend des Termitenabdomens an. Die fette Fliegenlarve reicht mit ihrem schmäleren Hinterende bis ins zweite Thorakalsegment des Wirtes; hier erkennt man bei durchsichtig gemachten Exemplaren unschwer die dunkle Stigmenplatte des Parasiten. Aus den Beobachtungen Dr. KALSHOVENS geht hervor, dass der

Myiagene dabei immer noch lebt, was in Anbetracht der Leere seines Kopfes gewiss merkwürdig ist. Doch man kennt bei Ameisen noch ganz andere Beispiele von Lebenszähigkeit. Donisthorpe erwähnt ein geköpftes Exemplar von *Myrmica ruginodis*, das in diesem Zustand noch 21 - 22 Tage lebte. Für den Myiagenen kommt das Ende jedenfalls viel früher, und zwar anscheinend kurz bevor oder nachdem die Phoridenlarve sich in ein Puparium verwandelt hat. Sie tut dies, ohne den Hinterleib des Wirtes zu verlassen, kehrt sich aber manchmal vorher darin um. Man findet daher das eine Mal die Puparien in derselben Orientierung wie die frisch eingewanderte Larve, das andere Mal mit den Hinterstigmen nach hinten (so in der photographischen Abbildung 24 Pl. 6); wieder in anderen Fällen ist das Abdomen der Termite seitlich aufgebrochen und das Fliegentönnchen ragt zur Hälfte aus der Öffnung heraus.

Puparium.

Material: Viele leere Tönnchen ohne die am Vorderende abgesprungenen Teile, meist noch vom abdominalen Integument des Termitensoldaten umhüllt (Pl. 6, Abb. 24). Ferner eine Anzahl unversehrter Tönnchen, die ich aus dem Abdomen gestorbener oder durch Einwerfen in Alkohol getöteter Soldaten herauspräparierte.

Gestalt: Kurz eiförmig, der Hinterpol breiter und flacher abgerundet als der Vorderpol, Querschnitt nur wenig von der Kreisform abweichend; Ursache dieser Abweichung ist, dass die Ventralseite des Tönnchens transversal ein wenig stärker gewölbt ist als die Dorsalseite. Im longitudinalen Sinne ist der Wölbungsunterschied ähnlich wie bei der Larve (Abb. 21) sehr auffallend. Länge $\pm$ 3.3 mm, maximale Höhe und Breite je 2.25 mm.

Die Gestalt des *Misotermes*pupariums weicht also von der aller bisher bekannten Phoridenpuparien bedeutend ab. Sie ist durchaus tonnenförmig, wie man es zwar bei den meisten Cyclorrhaphen, aber nicht bei den Phoriden gewohnt ist. Bisher galt eine mehr oder weniger kahn- oder selbst schildkrötenförmige Gestalt als für die Phoriden charakteristisch — also breiter als hoch, der Querschnitt linsenförmig oder einer längs der grossen Achse halbierten Ellipse ähnlich. Es ist sehr merkwürdig, dass wir gerade bei einer Aenigmatiine dieses tonnenförmige Puparium antreffen, da doch diese Unterfamilie wegen ihrer breiten und niedrigen Körperform ein dorsoventral abgeflachtes, jedenfalls kein im Querschnitt kreisförmiges Puparium hätte erwarten lassen.

Farbe: anfangs dunkel rotbraun, später schwärzlich, mit Aushnahme der stark glänzenden Stigmenplatte matt.

Oberfläche: Abgesehen von den stumpf kegelförmig erhabenen Hinterstigmen fast ohne Relief. Die bei der erwachsenen Larve vorhandenen lateralen Wülste und Einsenkungen sind ganz verschwunden, feine sternförmige Linienbündel und andere äusserst schwache Eindrücke lassen ihre ehemalige Lage eben noch erkennen. Die Segmentgrenzen verraten sich durch feine Furchen, die dorsalen Sekundärfurchen der Larve sind meist nur bei guter Beleuchtung erkenn-

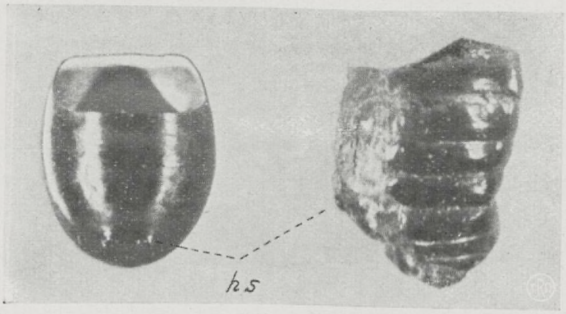

Abb. 24. *Misotermes exenterans*, Pupariumhinterhälfte; rechts vom abgebrochenen Abdomen des Myiagenen umhüllt, Seitenansicht; links enthüllt und von oben gesehen (hs Hinterstigmen). Mikrophot.

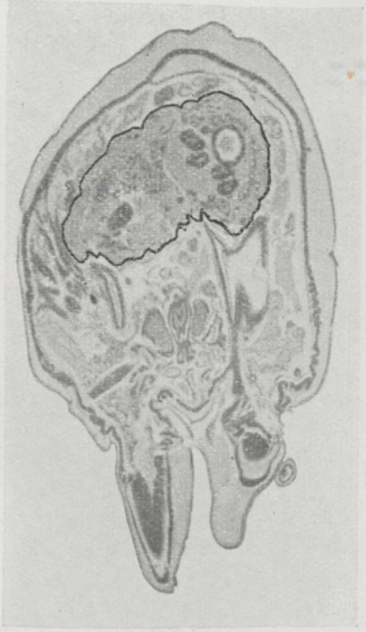

Abb. 20. *Macrotermes gilvus*, Frontalschnitt durch den Kopf der letzten Soldatenlarve; schwarz umrandet: *Misotermes*larve. Mikrophot.

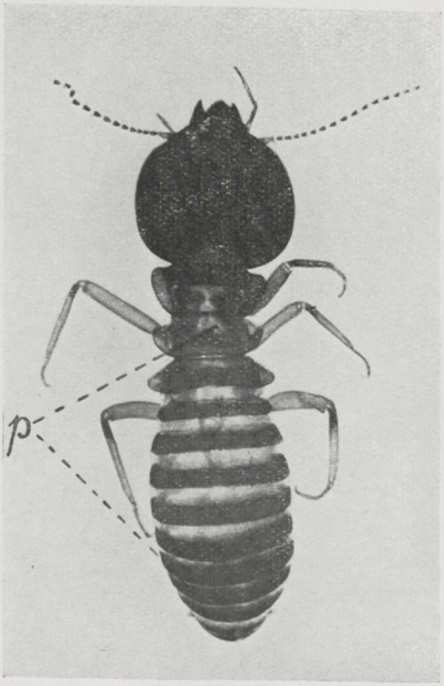

Abb. 31. Myiagener Soldat von *Macrotermes gilvus* von Java mit Abdominallarve p von *Misotermes exenterans*. Mikrophot.

bar (Abb.27). Die präformierten Sprengungsnähte der beim Schlüpfen abspringenden Teile sind am Puparium-Vorderende gut zu sehen.

Thorakalsegmente: Ihre Umrisse bei Seiten- und Vorderansicht sind aus Abb. 26 und 27 ersichtlich. In der Mitte des ziemlich flachen Prothorax liegt unmittelbar unter der Pupariumhaut das winzige larvale Cephalopharyngealskelett, das bei aufgehellten Präparaten mit seinen dunkeln Umrissen durchscheint (Abb. 26); sein Vorderende ragt als äusserst feine und kurze Spitze aus der Tönnchenoberfläche heraus. Nahe am Seitenrande liegen in elliptischer Einsenkung die larvalen Prothorakalstigmen. Meso- und Metathorax dorsal sehr verkürzt (Abb. 25).

Abdominalsegmente: Die drei ersten sind dorsal etwas länger als ventral, bei den fünf letzten herrscht das umgekehrte Verhältnis (Abb. 25). Am Vorderrand des zweiten Segments liegen rechts und links je 0.47 mm von der Mediane entfernt die Puppenstigmen (Abb. 27). Es sind elliptische Chitinringe von 0.13 × 0.09 mm Durchmesser, die mit einer glashellen, etwas nach aussen gewölbten Haut überspannt sind. Nach aussen durchbrechende Prothorakalhörner gibt es bei *Misotermes* im Gegensatz zu allen bisher bekannten Phoridenpuparien nicht. — Das achte Abdominalsegment ist etwas breiter als lang (Abb. 28). Nahe seinem ventralen Rande liegt die punktförmige Afternarbe. Die weit über der Mediohorizontallinie gelegene Stigmenplatte hat m.o.w. die bei der Larve beschriebene Form, nur die Farbe ist zu glänzendschwarz verändert.

Sprengungsweise: Beim Schlüpfen der Imago werden durch drei im lateralen Bereich des ersten Abdominalsegments Y-förmig zusammenstossende Bogenlinien (Abb. 25) zwei Stücke abgetrennt, eine Kalotte am Pupariumvorderende (Abb. 26) und eine dahinter gelegene längs und quer gewölbte dorsale Platte (Abb. 27).

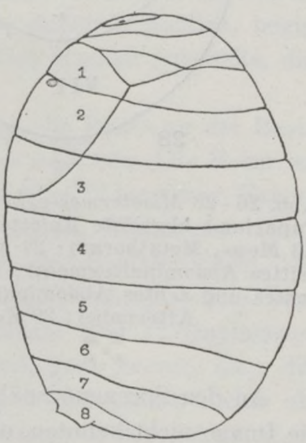

Abb. 25. ***Misotermes exenterans*, Puparium von rechts (1 - 8 erstes bis achtes Abdominalsegment).**

Die Kalotte setzt sich zusammen aus den beiden ersten samt dem grössten Teil des dritten Thorakalsegments und einer dreieckigen lateralen Partie des ersten Abdominalsegments. Vom Metathorax fehlt an der Kalotte nur ventral ein kurzer Streifen, in Abb. 25 zur Hälfte sichtbar. Die ventrale Metathoraxmediane wird von der Sprengungsnaht in der Weise durchschnitten, dass zwei Drittel zur Kalotte gehören, ein Drittel zum übrigen Tönnchen. Bei Abb. 26 muss beachtet werden, dass ihr unterer Teil, vornehmlich die Ventralpartie des Metathorax, perspektivisch verkürzt ist.

Die dorsale Platte (Abb. 25 im Profil, Abb. 27 von oben) wird durch zwei Bogenlinien aus dem ersten bis dritten Abdominalsegment herausgeschnitten. Der Metathorax hat an ihr keinen Anteil; ich habe mich sorgfältig vergewissert,

dass der Plattenvorderrand vorn oben (in Abb. 25 oberhalb der Ziffer 1) genau mit der Thorax-Abdomengrenze zusammenfällt. Der Hinterrand der Platte dagegen passiert die Medianlinie, wie es bei allen Phoriden der Fall ist, etwas vor der Grenze zwischen dem dritten und vierten Abdominalsegment und teilt die Mediane des dritten annähernd im Verhältnis von 4 : 1. Die in Abb. 27 angedeuteten Sekundärfurchen sind in Abb. 25 fortgelassen.

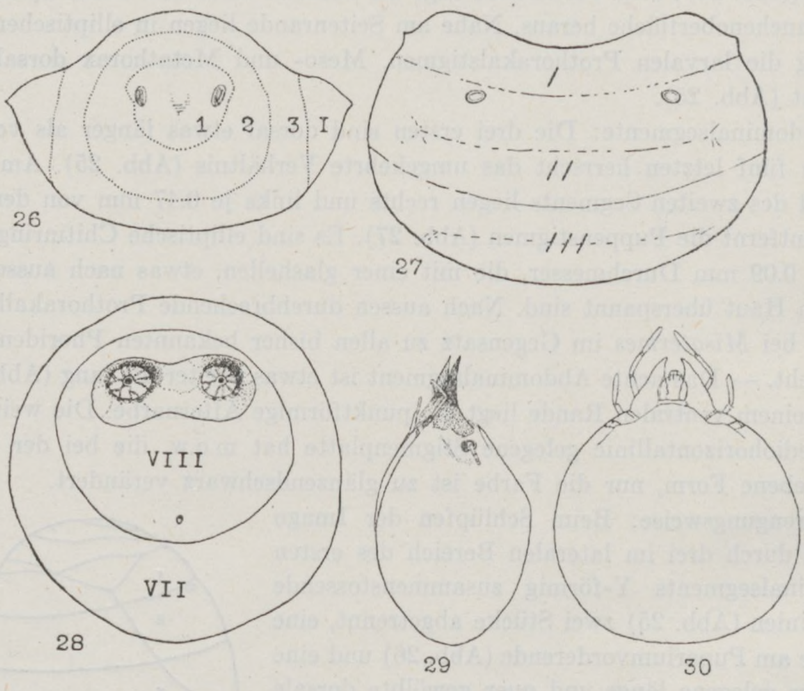

Abb. 26 - 28 *Misotermes exenterans*, 29 - 30 *Macrotermes gilvus*. 26 vom Vorderpol des Pupariums abgelöste Kalotte (1. Prothorax mit larvalen Stigmen und Schlundgerüst, 2.3 Meso-, Metathorax); 27 abgelöste Dorsalplatte des Pupariums (I, II, III erstes bis drittes Abdominalsegment); 28 Hinterende des Pupariums in Aufsicht (VII, VIII siebentes und achtes Abdominalsegment, letzteres dorsal mit Stigmenplatte, ventral mit Afternabe); 29 Kopf des Myiagenen von der Seite; 30 von oben.

An den Sprengungsnähten würde das *Misotermes*puparium, auch wenn wir die Imago nicht kennten, ohne weiteres als Phoridenpuparium zu erkennen sein. Zwar ist die Sprengungsweise nicht bei allen Phoridenpuparien die gleiche und nur innerhalb der Gattungen (nach meinen bisherigen Erfahrungen) vollkommen identisch. Aber die Kombination einer fast den ganzen Thorax umfassenden und bis ins erste Abdominalsegment reichenden Kalotte mit einer dorsalen Platte, welche aus den ersten drei Abdominalsegmenten herausgeschnitten ist und die Puppenstigmen im zweiten dieser Segmente zeigt, gibt es nur bei *Phoriden, Termitoxeniiden* und vielleicht bei *Sciadoceriden*. Die *Termitoxeniiden* kommen aber wegen ihrer Kleinheit, die *Sciadoceriden* wegen ihrer geographischen Verbreitung nicht in Frage.

4. Der myiagene Soldat von *Macrotermes gilvus* von Java (Pl. 6. Abb. 31).

Obwohl die myiagenen Soldatenformen heute für die Termitensystematik nicht mehr jene hohe Bedeutung wie zur Zeit ihrer ersten Entdeckung besitzen, weil sie inzwischen als pathogene Bildungen erkannt sind, so verdient doch der von Dr. Kalshoven entdeckte Myiagene eine nicht minder eingehende Beschreibung als seine Vorgänger und ist dabei sowohl mit dem normalen grossen soldaten von *Macrotermes gilvus* als mit der von Silvestri bei derselben Termite auf den Philippinen entdeckten myiagenen Form zu vergleichen.

Der normale *gilvus* vom Teakwald bei Semarang gehört zu der von Kemner 1934 als Hauptform betrachteten. Die von mir bei mehreren Individuen angetroffenen Masse (Soldaten) liegen alle innerhalb der aus Kemners Tabelle (l.c. S.71 und 74) ersichtlichen Variationsgrenzen.

Die Körperlänge des Myiagenen ist 7 - 9 mm und scheint die Länge des normalen grossen Soldaten nicht oft zu erreichen. Die Färbung ist durchweg heller als bei diesem, besonders an Kopf und Thorax. Beine blassgelb, Fühler bräunlich.

Kopf von oben gesehen rundlich (Abb. 30), jedoch der Seitenrand vorn etwas weniger gerundet als hinten. Grösste Breite gegen 3 mm, Länge mit Oberkiefern 3.72 - 3.8 mm, ohne Oberkiefer 3.02 - 3.07 mm. Höhe 2.1 - 2.2 mm, oben und unten gewölbt, von der Seite gesehen eiförmig (Abb. 29), die Oberseite nach vorn etwas stärker abschüssig, glatt, fast nackt. Fontanelle etwas vor der Mitte. Clypeus kurz, Oberlippe (Abb. 12) der des normalen Soldaten ähnlich, bogig nach vorn verschmälert, kürzer als die Kiefer, mit 5 - 6 Haaren jederseits, die hyaline Spitze halbmondförmig.

Die Mandibeln sind durchschnittlich 1.14 mm lang, die Breite an der Basis beträgt bei der rechten etwa 0.59, bei der linken etwa 0.48 mm. Die Form ist nicht immer vollkommen dieselbe wie bei dem zur Abbildung 17 benutzten Exemplare; es gibt solche, bei denen die Innenseite der rechten Mandibeln besser mit der Form der entsprechenden Mandibeln des normalen Soldaten (Abb. 13) übereinstimmt. Aber die Abweichungen sind nicht beträchtlich. Aus dem Vergleich der Abbildingen 13, 16 (normaler grosser Soldat) und 17 (myiagener Soldat), die in gleicher Vergrösserung gezeichnet sind, geht hervor, dass die Mandibeln des Myiagenen in unserem Falle im grossen und ganzen nichts als ein auf etwa drei Fünftel verkleinertes Abbild der normalen Mandibeln sind. Auch die Färbung ist die gleiche. Bei dem von Silvestri beschrieben philippinischen Myiagenen ist das ganz anders. Seine Oberkiefer (Silvestri l.c. S.6 Fig. II 4 - 5) erinnern stark an die von mir bei der vorletzten Soldatenlarve beschriebenen (Pl. 5, Abb. 19). Der Unterschied der beiden Myiagenen ist also der, dass in Bezug auf die Oberkiefer bei der philippinischen Form in der vorletzten Soldatenlarve eine vollständige Entwicklungshemmung auftritt, sodass überhaupt keine typischen Soldatenkiefer ausgebildet werden, während bei der javanischen Form eine Hemmung erst in der letzten Soldatenlarve bemerkbar wird und zur Bildung von verkleinerten aber typischen Soldatenmandibeln

führt. Vorausgesetzt ist hierbei, dass auch die Larve der philippinischen *Misotermes*art in die vorletzte Soldatenlarve eindringt, was sicher sehr annehmbar ist und von der javanischen Art durch die oben angeführte, allerdings bisher nur einmal gemachte Beobachtung wahrscheinlich gemacht werden konnte.

Maxillen bis zur Spitze der galea etwa 0.85 mm, in Grösse und Form wie beim normalen Soldaten, Aussenlade etwas länger als die Innenlade und vom Palpus um die Länge des 5. Gliedes überragt. Gula wie beim normalen Soldaten (Abb. 18).

Fühler meist 17-, seltener 18-gliedrig, in einem Falle selbst undeutlich 19-gliedrig, indem das 5. Glied unvollkommen geteilt ist. Bei diesem Exemplar nehmen Glied 2 - 4 allmählich an Länge ab, das 4. ist fast etwas breiter als lang, das aussen geteilte 5. Glied ist wieder so lang wie das zweite, deutlich dicker als die angrenzenden. Im Übrigen sind die Masse der Glieder 2 - 5 so veränderlich, dass wenig Allgemeingültiges darüber gesagt werden kann: Bei einen 17-gliedrigen Fühler sind 2 und 3 gleichlang, das 3. etwa 4/3 mal länger als das 4., dieses so lang aber unbedeutend breiter als das 5. Bei einem andern nehmen 2 3 4 5 allmählich an Länge ab, das 5. ist etwas schmäler als das 4. und 6. Bei vielen Exemplaren ist das dritte Glied länger als das zweite.

Der Thorax ist stets viel schmäler als der Kopf, sein Metanotum ist stets am breitesten, während beim normalen Soldaten das Pronotum am breitesten ist. Die Thoraxseiten sind aussen m.o.w. aufgebogen, am stärksten die Pronotumseiten. Pronotum ausserdem nach vorn und oben aufgebogen, 2.17 - 2.39 mm breit, in der Mittellinie 0.93 - 1.18 mm lang, vorn mitten eingekerbt, seitliche Vorderwinkel etwas gerundet, Seitenränder nach hinten konvergierend, Hinterwinkel breit bogig gerundet, Hinterrand sanft ausgebuchtet. Mesonotum 2.18 - 2.36 mm breit, etwa 0.57 mm lang, mit der grössten Breite vor oder in der Mitte, der Vorder- und Hinterrand etwas ausgeschweift. Metanotum 2.41 - 2.58 mm breit, etwa 0.63 mm lang, grösste Breite hinter der Mitte, Hinterrand fast gerade.

Hinterleib fast immer etwas breiter und höher gewölbt als beim normalen Soldaten, besonders wenn er eine erwachsene Larve des Parasiten beherbergt, dann auch heller gefärbt erscheinend.

Länge der Hintertibien 2.37 - 2.62 mm.

Vergleichen wir alle bisher bekannten myiagenen Formen miteinander, so zeigen sie manche übereinstimmenden Züge: Alle werden als Larven zu ihrem Schicksal determiniert, und zwar die von *gilvus* im vorletzten, also nach Ansicht vieler noch indifferenten Stadium, bei *malaccensis* mindestens im letzten, doch vielleicht auch im vorletzten. Der Kopf wird bedeutend verkürzt und hochgewölbt, die Breitenverhältnisse der Thorakalnota ändern sich, besonders wird das Pronotum relativ schmäler, das Metanotum breiter. Die Ausbildung der Mandibeln wird im verschiedenem Grade gehemmt; der myiagene *gilvus* von den Philippinen behält sozusagen Arbeitermandibeln, der myiagene *malaccensis* bekommt verkleinerte Soldatenmandibeln mit verbreiterter Basalpartie, der

gilvus von Java hat echte Soldatenmandibeln seiner Art, aber in verkleinerten Proportionen. Bei den *gilvus*-Myiagenen ist der Parasit eine Phoride der Gattung *Misotermes*, wahrscheinlich in zwei verschiedenen Arten auftretend, bei *malaccensis* ein unbekanntes Dipterengenus, das eine Phoride sein kann und jedenfalls zu den *Cyclorrhaphen* gehört.

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5. Einiges über den Parasiten der Soldaten von Macrotermes gilvus

von

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VORKOMMEN IN JAVA. Bisher fand ich parasitisch infizierte Soldaten nur in den Termitenhügeln von *Macrotermes gilvus* im Djatiwald bei Telawa (Mitteljava, SW von Semarang). Bei flüchtiger Untersuchung einigen Hügelnester in Indramajoe (bei Plosokerep) wurden keine gefunden. Auch nicht beim Abtragen eines *gilvus*-Hügels im Walde bei Bandjar (O. Preanger), als speziell nach ihnen gesucht wurde. Dr. FRANSSEN hat sie bisher bei Buitenzorg nicht angetroffen, obwohl er viel Material aus *gilvus*-Nestern dieser Gegend untersuchte. Da auch KEMNER, dem die Tiere sicher nicht entgangen wären, sie hier nicht gesammelt hat, kommen sie in Westjava offenbar nicht vor.

Bei Telawa wurde ihre Anwesenheit in den Hügeln bisher in den Monaten Januar, März bis Juni und Oktober festgestellt; sie werden da also wahrscheinlich das ganze Jahr hindurch zu finden sein.

AUFENTHALTSORT INNERHALB DES NESTES. Die Frage, ob die „Myiagenen", wie SILVESTRI diese Soldaten nennt, sich in bestimmten Nestteilen ansammeln, konnte nicht ganz geklärt werden. Beim Eröffnen der Hügel — wobei die Kolonie unvermeidlich stark beunruhigt wird, findet man einzelne Exemplare an den meisten Stellen, wo auch die normalen grossköpfigen Soldaten samt den übrigen Kasten vorkommen, also in den Gängen, den Pilzgärten, in der königlichen Zelle usw. Auf diese Weise sind sie offenbar auch von HAVILAND in Ma-

lakka und von Silvestri auf den Philippinen gefunden worden. Man begegnet ihnen jedoch nicht auf dem Verteidigungsposten bei den Öffnungen, der ja auch gewöhnlich mehr von den kleinen Soldaten besetzt wird. Das aus Einheimischen bestehende Personal in Telawa hat einige Termitenhügel vollständig aufgebrochen und untersucht und dabei den Eindruck gewonnen, dass die den Parasiten beherbergenden Soldaten hauptsächlich in den untersten Nestteilen vorkommen. In einem Falle seien nicht weniger als 106 Stück in einem Raum beisammen gewesen. Bei einer andern Gelegenheit, wo ich selber die vollständige Abtragung eines Hügels leitete, wurden faktisch auch wieder die meisten Myiagenen in den untersten Nestpartien und im Boden unmittelbar unterhalb des Hügels angetroffen. Hierin darf man wohl eine Bestätigung der von Kemner ausgesprochenen Vermutung erblicken, dass die Myiagenen, wenigstens in einem späteren Stadium ihrer Entwicklung und Infektion, in verlassene Gänge und ähnliche Örtlichkeiten geraten und so unter Umständen auch einmal isoliert gefangen werden konnten.

Sammelmethode. Die Myiagenen fallen unter den übrigen Nestgenossen ohne weiteres auf durch den anders geformten und auch heller gefärbten Kopf, aber auch durch den häufig etwas geschwollenen und helleren Hinterleib. Es war daher nicht schwierig, sie in grösserer Zahl zu sammeln und zur Beobachtung in Zuchtgläser und dergleichen zu übertragen, öfters in Gesellschaft von Arbeitern und anderen Stadien. Es gelang aber nicht, sie lange am Leben zu erhalten, höchstens bis zu zehn Tagen. Übrigens kann man auch sonst Teile einer Termitenkolonie, wenn es sich um eine pilzzüchtende Art handelt, nach einer so rohen Methode nicht länger als einige Tage gesund erhalten. Gerade einzelne parasitisch infizierte Soldaten hielten es hierbei im Vergleich zu den Arbeitern am längsten aus.

Betragen der Myiagenen. In ihrem Gebaren unterscheiden sie sich, wenigstens so lange die Made sich noch im Kopfe befindet, wenig von den normalen grossköpfigen Soldaten und den Angehörigen der andern Kasten: sie bemerken die geringsten Luftströmungen (z.B. bei vorsichtigem Abheben des Zuchtglasdeckels), zeigen die für Termiten so charakteristischen Ruckbewegungen, sperren die stark verkleinerten Kiefer bei Berührung ein wenig auf, lassen sich von den Arbeitern putzen und betteln bei ihnen auch um die von Mund zu Mund eingeflösste Nahrung. Nur die kräftigen Angriffe auf fremde Gegenstände, wobei die Kiefer zugeschlagen werden, führen die Myiagenen nicht aus.

Anzahl pro Nest. In einzelnen Nestern bei Telawa wurden keine gefunden, in diesen wurde aber auch nicht besonders nach ihnen gesucht. Bei den meisten Nestern, die von März bis Mai 1936 speziell auf Myiagene untersucht wurden, konnte eine Anzahl von Myiagenen regelmässig festgestellt werden. Indem wir möglichst alle normalen und infizierten grossen Soldaten von elf verschiedenen Nestern einsammelten (bei zehn Nestern waren die Sammler Einheimische, in einem Falle unter meiner Aufsicht), wurde in Mai versucht, zuverlässige Unterlagen für die Berechnung der Gesamtanzahl und des Prozentsatzes der Myiagenen zu erhalten. Es ergaben sich folgende Ziffern:

Nest Nr.	Grosse Soldaten		Gesamtzahl	% Infiziert
	Normal	Myiagen		
1	665	77	742	10 5
2	716	173	889	19.5
3	89	25	114	22
4	690	63	753	8.5
5	689	33	722	4.5
6	506	21	527	4
6	283	68	351	19.5
8	684	114	789	14
9	22	35	57	61.5
10	5	108	113	95.5
11	7	1314	1321	99 5

Das sind alle untersuchten Kolonien der gewöhnlichen, verhältnismässig kleinen Termitenhügel aus schwarzem Lehmmergel in der unmittelbaren Umgebung der „Dessa" Gedangan bei Telawa. Die Reihenfolge in der Tabelle ist aber so gewählt worden, damit deutlich hervorspringt, dass der Prozentsatz in den meisten Nestern — dazu gehört das von mir kontrollierte — 4 % bis 22 % betrug, während er in den drei andern Fällen viel höher war. Besonders die auf Nest Nr. 11 bezüglichen Ziffern sind auffallend, da hier eine ungewöhnlich hohe Zahl von Myiagenen und daneben nur einige wenige normale Soldaten gezählt wurden. Da kein Grund zu der Annahme vorliegt, dass hier Fehler gemacht wären, so führe ich diese Ziffern mit an; Bestätigung ist allerdings erwünscht. Es ist ferner möglich, dass die Zahlen im allgemeinen kein gutes Bild der tatsächlichen Verhältnisse geben, weil ein grosser Teil der Kolonie bei Störung des Nestes in den Gängen unter dem Boden verschwindet.

Silvestri schätzte die Zahl der in drei von ihm auf den Philippinen untersuchten Nestern vorhandenen Myiagenen auf ± 50. Dies liegt in der Nähe der meisten von mir gefundenen Zahlen.

Entwicklungsgeschichte der Phoride. Bald nachdem einer grössere Zahl von abnormalen Soldaten in Beobachtung genommen war, zeigte sich, dass unter den kurz darauf verendeten Exemplaren mehrere waren, deren Abdomen dicker, kürzer und dunkeler gefärbt erschien, und dass der Grund davon ein im Abdomen entstandenes Fliegenpuparium war. Dies ereignete sich vom zweiten bis zum neunten Tag nach dem Einfangen, und zwar bei zwei Partien von ungefähr 1000 Individuen bei 24 % resp. 27 %. Der Kopf dieser Exemplare erschien ganz durchsichtig und leer. Hieraus schloss ich, dass die Fliegenmaden nicht im Kopfe bleiben, wo sie von Kemner und Silvestri gefunden wurden, sondern im weitern Verlauf ihrer Entwicklung ins Abdomen wandern und sich dort zum Puparium wandeln. Die übrigen gefangen gehaltenen Exemplare starben ebenfalls innerhalb derselben Zeit, aber in ihrem Körper bildete sich kein Puparium, offenbar weil zur Zeit ihrer Versetzung in das Beobachtungsglas die parasitische

Made noch nicht weit genug entwickelt war. Mein Aufseher Mas Soediro Kartohadibroto, der sich beim Sammeln von Material wieder sehr verdient machte, lernte schon bald diejenigen Exemplare, die nahezu „reif" waren, an ihrem auffallend weissen Hinterleib herausfinden. Das Integument des Soldatenabdomens war wie ein dünnes, leicht entfernbares Häutchen über das Puparium gespannt. Der Vorderteil der Soldatenleiche liess sich ebenfalls leicht von dem das Tönnchen beherbergenden Hinterleib trennen. Eine Anzahl Puparien wurde für kurze Zeit täglich aus dem Material ausgelesen und in einem feuchten Raum möglichst frei von Schimmelpilzen aufbewahrt. Bei der angewandten etwas rohen Methode lieferte nur die Hälfte der Puparien eine Imago und zwar nach 12 bis 15 (oder 16?) Tagen. Die eben geschlüpften Fliegen waren an den noch nicht entfälteten Flügeln kennbar, die wie platte Stäbchen nach hinten vorragten. In den *gilvus*-Nestern wurden bisher noch keine toten Myiagenen mit oder ohne Puparium, auch keine Fliegen gefunden. Hierin kann man wieder ein Anzeichen dafür erblicken, dass sich die von einem Parasiten befallenen Individuen zur Zeit, wo der Parasit voll entwickelt ist, in tiefere oder abgelegene Teile des Nestes zurückziehen, oder vielleicht von den Arbeitern als Leichen dorthin gebracht werden. Aus der Tatsache, dass Silvestri, der doch eine ziemlich grosse Anzahl von Myiagenen untersucht zu haben scheint, nur solche Individuen vor sich hatte, bei welchen die Parasitenlarve noch im Kopf des Wirtes war, kann man wohl schliessen, dass diese Maden erst verhältnismässig spät, kurz vor der Verpuppung, in den Hinterleib des Wirtes einwandern.

Weitere Beobachtungen meines Aufsehers haben deutlich ergeben, dass die Myiagenen, auch nachdem die Fliegenlarve ins Abdomen eingedrungen ist, noch einige Zeit, etwa zwölf Stunden lang am Leben bleiben. Ferner ersehe ich aus den Aufzeichnungen, dass in einigen Fällen Myiagene mit Abdominallarven schon bei Untersuchung der Termitennester erhalten wurden. Doch waren das Ausnahmen. Die meisten so eingesammelten Myiagenen hatten die Parasitenlarve noch im Kopf, und die ersten Exemplare mit Abdominallarven wurden dann in der folgenden Nacht oder dem darauf folgenden Tage erhalten. Die Bewegungen der Abdominallarve im Termitenabdomen machen sich auch äusserlich ein wenig bemerkbar.

Betragen der Fliegen. Die in Gefangenschaft gehaltenen Fliegen zeigten sich ungemein flink und lebhaft, echt nach Phoridenart. In den Zuchtgläsern liefen sie behende an den glatten Wänden entlang und fielen dann wieder herunter. War feuchte Erde auf dem Boden, dann setzten sie sich gern darauf zur Ruhe nieder. Mit lebenden Termiten zusammengebracht liessen sie sich von diesen immer aufs neue beunruhigen und suchten ein ungestörtes Plätzchen zu finden. Dass sie von Pilzgärten oder andern Nestteilen etwas als Futter zu sich genommen hätten, wurde nicht beobachtet, auch für Honigtropfen zeigten sie kein Interesse. Länger als zwei Tage konnten die Imagines nicht am Leben erhalten werden. Bei gesunden Exemplaren fallen die hellen Vorderbeine auf, der Rücken ist glänzendschwarz, der Hinterleib oben und seitlich grau, unten heller. Einige Male wurden Bewegungen wie zum Eierlegen beobachtet, wobei

die Fliegen auf dem Boden sassen und den Hinterleib tief zwischen die Erdkrümchen brachten. Dabei wurde immer wieder der Platz gewechselt und die noch vorgestreckt gehaltene Legeröhre eifrig mit Hilfe der Hinterbeine gereinigt. Das alles wurde im Wechsel mit Ruhepausen oft wiederholt.

DAS EI. Nach solchen Vorgängen waren natürlich Eier in den Zuchtgläsern zu erwarten und leicht zu finden. Sie sind weiss, 0.85 - 0.95 mm lang, 0.25 - 0.3 mm breit, zylindrisch, schwach gebogen, mit etwas zugespitzten Enden (das eine Ende spitzer als das andere) also spindelförmig mit leichter Krümmung. Bei länger beobachteten Eiern wurden die Pole durchsichtig, während die mittlere Partie mattweiss blieb. Nach ca 6 Wochen sahen einige wenige noch gut aus, schlupten aber nicht und verdarben auch schliesslich.

Offenbar haben die Weibchen eine starke Reproduktion. Dies und die bereits mitgeteilten und noch anzuführenden Beobachtungen über das Betragen der Fliegen und der Termiten lassen erkennen, dass die vorläufige Vermutung KEMNERS, die Eier würden auf dem Kopf der Termiten selbst abgelegt, aufgegeben werden muss.

VERHALTEN GEGENÜBER DEN TERMITEN. Die Arbeiter und kleinen Soldaten von *M. gilvus* benahmen sich deutlich in feindlichem Sinne gegenüber den in den Zuchtgläsern anwesenden Fliegen. Sie erkannten diese sofort als Fremdobjekte, denen gegenüber die Ruck- und Angriffsbewegungen ausgeführt wurden. Einigen Fliegen, die mit ihren Flügeln am Glase kleben geblieben waren, wurden schon sehr bald die Beine abgebissen und Teile aus den Flügeln gerissen, und in sehr kurzer Zeit waren sie getötet.

Die Frage liegt nahe, ob die vorliegende parasitische Phoride auf den Gesundheitszustand, das Widerstands- und Entwicklungsvermögen der Termitenkolonie einen merkbaren Einfluss ausübe. Aus den mitgeteilten Zahlen und Beobachtungen lassen sich diesbezüglich keine bestimmten Schlüsse ziehen. Man hat nicht den Eindruck, dass die grossköpfigen Soldaten als Nestverteidiger eine besonders wichtige Rolle spielen, im Gegenteil, eher den, dass sie ganz gut entbehrt werden können. Eine gewisse, eigentlich für die Nestgenossen bestimmte Futtermenge geht natürlich verloren, aber auch das scheint nicht von Bedeutung. Man wird der Phoride wohl kaum eine grössere Rolle zuschreiben dürfen als den übrigen, nichtparasitischen „Kommensalen".

Buitenzorg, 25 Juni 1936.

6. Weiteres über das Benehmen der Misotermes Abdominal Larven und der Myiagenen.

Von

Dr. L. G. E. KALSHOVEN

(Buitenzorg).

Im Jahre 1937 hatte ich nochmals Gelegenheit in Gedangan einige weitere Beobachtungen über das Betragen der Parasitenlarven und ihrer Wirte zu machen, nachdem ich schon das Manuskript von Herrn Dr. SCHMITZ durchge-

sehen hatte. Leider fand ich keine Zeit Herrn SCHMITZ über die neuen Befunde zu unterrichten.

Es wurden im Februar einige Hunderte der Myiagenen gesammelt und in Petrischalen aufgehoben, wo man durch Beleuchtung von unten her die Exemplare, in welchen die Larven gerade in das Abdomen eingewandert waren, durch den durchsichtigen Kopf erkennen und herauslesen konnte.

Einige Zeit nach der Durchwanderung war zu sehen, wie an der linken Seite des Abdomens im membranösen Pleurum eine helle Stelle entstand. Es zeigte sich, dass die Made hier eifrig mit dem Kopfende beschäftigt war. Die Bewegungen waren leicht zu erkennen an den von Dr. SCHMITZ abgebildeten chitinösen Teilchen (Abb. 22 auf Seite 385), welche durch die dünne Haut hin zu sehen waren. Der Kopf wurde wiederholt etwas nach vorn gestreckt (dem Abdominalende des Wirtes zu), dann hochgehoben und so rückwärts gezogen. Derartige Bewegungen der Larve wurden längere Zeit fortgesetzt, dann und wann von Ruheperioden unterbrochen, und nicht nur am linken Pleurum entlang, sondern auch an der ventralen Seite des Abdomens und an dem rechten Pleurum — seltener an der dorsalen Seite —, aber immer in der Nähe des Abdominalendes des Wirtes. Allerdings war es an dem linken Pleurum, wo die Mundteile der Larven wiederholt dicht an die Wand gedrückt wurden, am besten zu sehen. An dieser Stelle erweiterte sich die durchsichtige Stelle allmählich, weil sich in der Spitze des Abdomens eine weiszliche Flüssigkeit ansammelte. Dies dauerte so lange bis schlieszlich die dünne Haut perforiert wurde und ein Tropfen der weissen Flüssigkeit heraus trat. Fast immer war diese Stelle zwischen dem vierten und fünften Sternit an der Seite gelegen.

Beim Beobachten des Vorganges bekam ich den Eindruck, dass es sich bei der Made im Anfang um das Gewebe im Abdomen des Wirtstieres zu zerstören handelte, vielleicht auch um es zu sich zu nehmen; obwohl das letzte unwahrscheinlich sein muss auf Grund der von SCHMITZ konstatierten starken Rückgängigkeit der Mundteile im dritten Larvenstadium. Es war bisweilen zu sehen wie das Pleurum auf der Stelle, wo sich die Mundteile der Larve befanden, ein wenig eingezogen wurde, wie festgehakt, oder auch eingesogen durch die Larve. Im letzteren Teil des Vorganges war die Larve offenbar vielmehr damit beschäftigt die Wand zu zerreiszen. Es wurde der von SCHMITZ beschriebene kleine Dorn immer kräftiger an die Wand entlang nach oben und rückwärts gezogen.

Das Durchbohren der Haut wurde dann immer sofort gefolgt durch eine Umdrehung der Larve im Abdomen. Dieser Vorgang war ziemlich gut zu folgen, als dann die grosse hintere Stigmenplatte der Made an die Wand erschien und von der Basis des Abdomens her nach dem Ende wanderte, wo sie gerade an der perforierten Stelle zurecht kam. Es folgte dann wieder eine Serie Bewegungen der Larve, jetzt aber mit dem Hinterende, was sehr deutlich zum Zweck hatte mit den etwas hervorragenden und rohen Stigmen die Öffnung zu vergrössern und die grossen Stigmen ins Freie zu bringen.

Der so weit beschriebene Prozess in all seinen Einzelkeiten wurde nur dreimal in einer Strecke gefolgt, die einzelnen Vorgänge aber häufiger.

Nur bei einem Exemplar wurde nachher gesehen das die Stigmen auf der rechten Seite des Abdomens zum Vorschein gebracht waren.

Es ist jetzt klar, dass man beim Untersuchen von frisch gesammelten und dann fixierten Myiagenen, wie Dr SCHMITZ es machen musste, die Maden mit dem Kopfende nach hinten, sowohl als auch nach vorne, antreffen kann.

Nachdem die Larve sich umgedreht hat, beginnt die Verwandlung ins Puparium, wobei sie sich verkürzt und die Haut des Abdomens des Myiagens sich sehr straff spannt. Die Verwandlung ins Puparium kann man insofern gut verfolgen da erst eine rötliche und schliesslich eine dunkelbraune Farbe auftritt. Die Haut des Soldatenabdomens, welche an der Spitze und Basis noch mit einer dunklen Masse gefüllt ist, ist in wenigen Tagen verfault und löst sich vom Puparium ab.

Die Notwendigkeit des Freimachens der Stigmata ist klar, da in den verwesenden Teilen des verendeten Wirtes die Atmung sonst nicht mehr möglich wäre.

Es wurden die folgenden Zeitaufwände für die verschiedenen Stufen notiert:

Vom Überwandern der Larve bis zum Durchbohren der Wand waren es 7; 9½; 11; 11; 11 Stunden.

Vom Perforieren der Wand bis zur Verpuppung ½; 1¼; 1½; 1½; 2; 2¼; 2½ Stunden.

Vom Anfang des Verpuppens bis zur Schwärzung des Pupariums etwa 2 - 2½ Stunden.

Der ganze Prozess, welcher sich nach obiger Aufgabe also in 9½ bis 14 Stunden erledigen kann, kann sich offenbar aber auch rascher volziehen, weil in anderen nicht in Unterteile notierten Fällen von der Überwanderung der Larve bis zur Volendung des Pupariums auch Zeitaufwände von 7 (einmal), 8 (einmal) und 9 (zweimal) Stunden aufgezeichnet wurden.

Über das Verhalten der Myiagenen während dieses Prozesses kann noch einiges mitgeteilt werden. Es wurde nochmals bestätigt, dass die Tiere, auch nachdem die Larven aus dem Kopf ins Abdomen übergewandert waren, in der ersten Zeit noch dieselbe Aktivität zeigten wie vorher. So waren sie noch für Licht empfindlich und beim Beunruhigen schlugen sie mit den Mandibeln auf das Substrat (bei trocknem Papier hörbar!). Allmählich wurden sie aber langsamer in ihren Bewegungen. Wenn das Abdomen perforiert war, waren sie nicht mehr imstande sich fort zu bewegen oder aufrecht zu halten. Sie konnten dann aber die Antennen und Beine noch bewegen. Erst wenn das Puparium sich schon geformt hatte oder kurz nachdem dies geschah, war das Wirtstier verendet.

Dieses Verhalten der Myiagenen tut auch wieder vermuten, dass erst während der „bohrenden" Wirkung der Larve wichtige innere Teile zerstört werden.

Juli 1938.

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Vom Perforieren der Wand bis zur Verpuppung ¾; 1¼; 1½; 1¾; 2; 2¼; 2½ Stunden.

Vom Anfang des Verpuppens bis zur Schwärzung des Pupariums etwa 2–2½ Stunden.

Der ganze Prozess, welcher sich nach obiger Aufgabe also in 9½ bis 14 Stunden erledigen kann, kann sich offenbar aber auch rascher volziehen, weil in anderen nicht in Einzelteile notierten Fällen von der Überwanderung der Larve bis zur Vollendung des Pupariums auch Zeitaufwände von 7 (einmal), 8 (einmal) und 9 (zweimal) Stunden aufgezeichnet wurden.

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Juli 1938.

INDO-MALAYAN AND PAPUAN MICROLEPIDOPTERA.

1. Notes on the Tropical Tobacco Moth, Setomorpha rutella Zeller. (Tineidae) [1]

by

A. DIAKONOFF

(Commercial Museum of the Royal Colonial Institute, Amsterdam).

Introduction and acknowledgments.

Setomorpha rutella Z. is a well known pest of various animal and vegetable products, and has a circumtropical distribution. As all geopolite [2]) insects in general, and the injurious and polyphagous species in particular, it enjoys the privilege of having been described as a new species on various occasions, when it was recorded in a new country or a new product. Thus it has been attributed during the last 80 years — as it now appears — to about 9 genera and has acquired about 15 synonyms.

Since 1932 *S. rutella* was recorded several times in the papers of the Deli Experiment Station, Medan and the Institute for Plantdiseases, Buitenzorg as being injurious to *cured tobacco leaves* in Sumatra and Java. The mentioning of this name was based on determinations by the late Mr. E. MEYRICK, to whom specimens had been submitted directly or through the mediation of the Imperial Bureau of Entomology, London.

At that time one more name had already appeared in the literature on economic entomology in the Netherlands Indies for a *Setomorpha* species which

[1]) We propose the predicate "Tropical" in order to avoid confusion with the "Tobacco Moth", *Ephestia elutella* HB.
[2]) With Prof. M. HERING, Berlin, we think this a better term than "cosmopolite".

had showed itself very injurious to *cured tobacco* in East and Mid Java during the great war; viz. *S. margalaestriata* KEUCHENIUS (1925). DAMMERMAN in his Agricultural Zoology of the Malay Archipelago (1929) had considered this species to be *S. tineoides* WALS. Later on the supposition arose among the Neth. Indian entomologists that *S. margalaestriata* might prove to be identical with *S. rutella*.

The Director of the Imperial Institute of Entomology, Prof. Dr. GUY A. K. MARSHALL, when being asked for his opinion on this matter, wrote on Aug. 21, 1935, to the Institute for Plant Diseases: "......the oldest name (of the species) "is apparently *Setomorpha insectella,* F., of which *S. rutella,* ZELL., is undoubtly "a synonym. It appears also fairly certain that *S. margalaestriata* KEUCH., will "prove to be another synonym of this species, but it is not easy to be certain "of this merely from the description...... I think DAMMERMAN's reference to "*Setomorpha tineoides,* WALS., is almost certainly incorrect. This insect is quite "distinct from *insectella* and should be referred to the genus *Myrmecozela*. "There does not appear to be any evidence that it is a pest of tobacco". On this authority the name *S. insectella* was also introduced in the Neth. Indian literature.

Recently the present author was asked to solve this nomenclatory puzzle and for this purpose material was sent to him by the mentioned Institute and by the Besoeki Experiment Station, Djember, Java, where KEUCHENIUS had worked formerly. Through the kind cooperation of several other foreign and Dutch institutions interesting material from other sources could be brought together and studied. In this way the author was enabled to take up the rather intricate question of the identity of the several species involved, on a broad basis.

We desire to express our gratitude in the first place to Dr. L. G. E. KALSHOVEN, Chief Entomologist at the Institute for Plant Diseases, Buitenzorg for the incitement to start the present study and for frequently furnishing us with important and interesting material from the collection of that Institute and with information; to Prof. Dr. DE BUSSY, Director of the Commercial Museum of the Royal Colonial Institute, who encouraged us in carrying out the present investigation; to the wellknown specialist in genital characteristics of Lepidoptera, Mr. F. N. PIERCE, Warmington, England, who has taken the trouble of examining the genitalia of the type-specimen of *Tinea misella* Z. in the British Museum; to Mr. R. WASHBOURN, British Museum Natural History, who kindly sent us photographs of the genitalia of some type-specimens in that collection; further to the following Institutions, besides the two already mentioned, which sent us material for examination: Zoological Museum, Kiel; State Museum for Natural History of the Academy of Sciences, Stockholm; Laboratory for Entomology of the Agricultural University, Wageningen; Zoological Museum, Leiden and Zoological Museum, Amsterdam.

Historical Remarks.

Short history of Setomorpha rutella.

In 1852 (1) [1]) ZELLER, in a paper on a collection of Microlepidoptera from Africa, described a small moth represented by 1 ♂ and 2 ♀♀ as *Setomorpha* (a new genus) *rutella* n. sp. In the following twenty years the same author published four new names for the same species, as appeared later on (61).

It is BUSCK's merit to have published in 1906 (56) a study of *Setomorpha rutella* Z. as far as North American forms are concerned.

A still more extensive list on the synonomy and literature followed in 1908 (61) by LORD WALSINGHAM, who added 8 synonyms to the list already known and classified this species as a geopolite pest of vegetable and animal materials. In his zeal for gathering synonyms WALSINGHAM even declared that the oldest name then known, i.e. *rutella* Z. was a synonym of *Tinea insectella* F., which was taken in 1794 by FABRICIUS in a box with dried insects from Africa. This conclusion is incorrect, as will be explained in another portion of this paper.

Records of Setomorpha species and tobacco moths in the Netherlands Indies.

In the collection of the Leiden Museum the author found a specimen labelled: "*in bird skins,* 15.VI.1880, Sw.", which seems to be the first finding of *Setomorpha* in the Netherlands Indies. Afterwards M. C. PIEPERS collected the species in Celebes (Makassar and Maros) and on the Island of Saleyer. This material was described by SNELLEN under the name *S. corticinella* (1885, 28), on which occasion beautiful figures of the moth were reproduced. In the Leiden Museum we also found material labelled: Java, Batavia, 1888, 1889 and 1891.

From SNELLEN's description and figures WALSINGHAM concluded in his paper (1908, 61) that *S. corticinella* SN. is one of the synonyms of "*S. insectella* F."

A score of years after SNELLEN's records a not further defined small moth was recorded as living on tobacco seed and in cured tobacco leaves in Deli, Sumatra's East Coast by DE BUSSY (1909-'10, 64, 65), [2]) while in 1915 (70) KEUCHENIUS draw the attention to the very injurious occurrence of a tobacco moth in Djember, East Java, which he could not identify, however, with the Deli tobacco moth, apparently through lack of specimens for comparison.

In 1917 specimens of the Java tobacco moth were sent by him to the Leiden Museum, where they were determined by VAN EECKE as *Setomorpha tineoides* WALS. KEUCHENIUS rejected this identification referring to the description and figures of VAN DEVENTER (Tijds. v. Entom. 1903, p. 81) both of them relating to a distinctly different species. Thus he made a new description of the tobacco moth and named it *S. margalaestriata* (1917, 76).

As said in the introduction, DAMMERMAN (1919, 83 and 1929, 94) did not

[1]) The figures between ( ) correspond with those in the list of literature references on *Setomorpha* in the systematical part.

[2]) Already in 1907 this author records moths injurious in tobacco seed in Deli (63); we are, however, not quite certain, whether this applies to *S. rutella* Z., because in the collection of the Commercial Museum of the Colonial Institute we found specimens labelled "moths from *tobacco seed*" from Deli of about that time, which are not this species but belong to *Corcyra cephalonica* STT., commonly known as the Rice Moth.

accept the new species of KEUCHENIUS — not even mentioned it at all — and recorded the tobacco moth as *S. tineoides* WALS.

JENSEN (1921, 85) in a review on pests and blights of tobacco in the Vorstenlanden, Java, gave an extract from KEUCHENIUS' morphological and biological notes, adding a set of figures to it (including one of the male genitalia) and two coloured plates of the various stages and of the larva in situ.

In his list of injurious tobacco insects of Deli VAN DER MEER MOHR (1932, 105) published a description and photographs of the Deli tobacco moth, calling it *S. rutella* Z. on MEYRICK's authority and stating that it was still unknown, whether this species was identical with the *S. margalaestriata* KEUCH. which had quite the same habits in any case. In his later list of tobacco insects of the world (1935, 109) the same author emphasises this synonymy with more stress.

Fig. 1. *Setomorpha rutella* Z. ♂ (Coll. Inst. Plant Diseases, Buitenzorg). 10 × (Phot. K. VAN DER VEER).

The same suggestion is then found in a paper of KALSHOVEN (1938, 120) who mentions *rutella* for Sumatra as well as for Java (determinations by MEYRICK), adding in a note that this species is considered by Prof. MARSHALL again to be a synonym of *S. insectella* F.

Summing up, five names for *Setomorpha*-species have been recorded as occurring in the Netherlands Indies: *corticinella* SN., *insectella* F., *rutella* Z., *margalaestriata* KEUCH. and *tineoides* WALS.

Critical study of old and new data.

Examination of types.

The study of the identity of *Setomorpha* moths is not an easy one on account of the inconspicuous and variable colouring: the groundcolour varies considerably and more so the markings on the forewings. Besides the wing-neuration, often considered to be such an important taxonomic character, in this case does not lead to a definite conclusion, since in *Setomorpha* it is variable too; even resulting in new genera having been called into existence for the same

species. However, the study of the internal and external chitinous parts of the genital apparatus more and more appears to be a better auxiliary in the taxonomy of Microlepidoptera and in the present question it proved to be the only sure way. Contrary to the species of the genus *Tinea* L. where ♂ as well as ♀ show rich taxonomic characteristics in the genital parts, the genital apparatus of the ♀ in *Setomorpha* does not offer many particulars which can be used in characterising the species, and therefore only the male genitalia remained as trustworthy guides in the present study.

In order to solve the nomenclatory puzzle of the *Setomorpha* species of the Malayan Archipelago, we had to ascertain in the first place, whether Lord WALSINGHAM was right in asserting that *rutella* Z. is a synonym of *insectella* F. In his paper this author points out that in the description of *insectella* a misprint has been introduced, making it incomprehensive. Furthermore he states: "The genus *Setomorpha* Z. is thus regarded as consisting of the single species *insectella* F. There seems little doubt that FABRICIUS described *rutella* Z. under the name *insectella*......" without giving, however, any argument or proof for this opinion. There is no evidence, that LORD WALSINGHAM ever should have seen the type-specimen of *Tinea insectella* F. This was the reason why the great specialist in Microlepidoptera, the late Mr. MEYRICK, could not accept the name *Setomorpha insectella* F. and regarded the name *Setomorpha rutella* Z. as absolutely correct. Some other authorities, on the contrary, i.e. the British Museum, accepted WALSINGHAM's alteration.

To have this question settled once and for all the Fabrician type specimen of *Tinea insectella* had to be found and studied. Fortunately the unique, 146-year old specimen appeared to be well preserved in the Kiel Museum and its Director, Dr. OLAW SCHRÖDER was kind enough to send this specimen — a male — to the Colonial Institute for investigation and permitted us to prepare a microscopic slide of the genitalia.

The result of this investigation was rather unexpected as the specimen proved to belong to *Tinea misella* Z., a moth common in animal and vegetable material, with an European distribution (as far as known). This discovery will be published more extensively elsewhere.

There is no reason at all to be suspicious of the identity of the Fabrician type-specimen of *Tinea insectella*. It was well-labelled and well preserved in the Kiel Museum. Moreover we have closely compared the handwriting on the label with specimens of Fabrician labels in HORN and KAHLE's work "Über entomologische Sammlungen" (1935 - 1937, pl. 19 and 30), and we have no doubt that the handwriting is the same. It was generally known that these types of FABRICIUS were preserved in the Kiel Museum [1]).

[1]) *Tinea insectella* F. was taken by FABRICIUS, very probably alive, in a box with dried insects (hence the name), from Africa. This, however, gives no certainty whatever, that this specimen also should have come from that country: the infection of the insect box may have taken place on the working desk of the great naturalist or somewhere else in Europe as well. The possible objection that *T. insectella* cannot be the same as *T. misella*, the first being an African, the second an European species, is not tenable.

Furthermore the type-specimen of *Setomorpha rutella* ZELLER had to be investigated. The two cotypes of this species (♂ and ♀), were, according to WALSINGHAM, in the Stockholm Museum, while the third cotype-specimen (♀) was in his own collection (now in the British Museum). Thanks to the kindness of the Director of the Entomological Section of Naturhistoriska Riksmuseet at Stockholm, Dr. B. Y. SIÖSTEDT, we could investigate the genitalia of the male type-specimen, which was very well set and in perfect condition. The investigation has proved that this species is identical with all male specimens, studied by us, of *S. corticinella* SN. (being SNELLEN's cotype-specimens in the Leyden Museum), "*S. insectella* F." and *S. rutella* Z. from Java and Sumatra and also of ♂ specimens of the tobacco moth received from the Besoeki Experiment Station, which can be considered as cotypes of *margalaestriata* KEUCH.

Therefore this last name proved to be a synonym, as already assumed by several authors (VAN DER MEER MOHR (105), KALSHOVEN (120), STRINGER — in lit.).

Thus only one *Setomorpha*-species, viz. *S. rutella* Z. remains, as occurring in the Netherlands East Indies.

The name *S. insectella* F. is very far from being established, as on the authority of the late Mr. MEYRICK this insect has been universally called *S. rutella* Z. In future it will be a relief for systematic, as well as for economic entomology, that the name *Setomorpha rutella* Z. is fixed once for all.

Finally it may be stated that from Mr. WASHBURN's photographs of the genitalia of *S. rupicella* Z. from South America it appeared beyond all doubt that this species is also a synonym of *S. rutella* Z.

Diagnose of the genus Setomorpha Z.

Genus **Setomorpha** ZELLER.

Lepid. Micropt. Caffr. 93 - 94, 1852.

Semiota DIETZ 1905, Tr. Am. Ent. Soc. *31*, 18, pl. 6, f. 4; *Epilegis* DIETZ 1905, Tr. Am. Ent. Soc. *31*, 16, pl. 4, f. 2; *Apotomia* DIETZ 1905, Tr. Am. Ent. Soc. *31*, 17, pl. 4, f. 4; *Trisyntopa* LOWER 1918, Tr. R. Soc. S. Austr. *42*, 238.

Head densely covered with appressed scales, vertex roughish, face rather smooth, both very broad, face in male a little prominent. Eyes moderate, black. Ocelli obsolete. Tongue and maxillary palpi absent. Antennae reaching to ¾ of forewings, smooth, naked or hardly pubescent in male, basal joint thickened with dense, appressed scales. Labial palpi moderate, recurved, first and second joints rounded, with a few rough scales beneath; second joint externally with 5 - 6 strong setae, third joint about as long as half of the second, smooth, flattened, its apex truncate. Legs moderate, posterior tibiae with long hairs on upper side.

Wing neuration (fig. 2 and 3) is rather variable, besides sexual differences. Forewings lanceolate, apex acute. 12 veins, sometimes 11, vein 4 being very often absent in male, vein 8 being sometimes absent in female; 3 and 4 connate

in male, stalked in female (seldom approximated); 5 and 6 connate or stalked; 8 and 9 out of 7. Parting vein present.

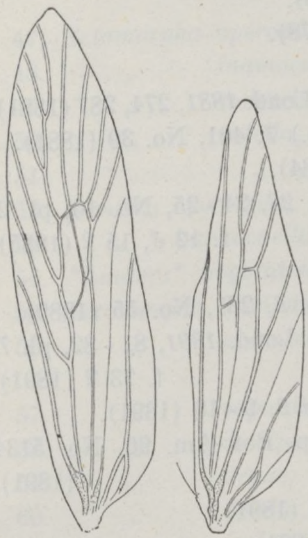

Fig. 2. Wing neuration in male (18 ×).

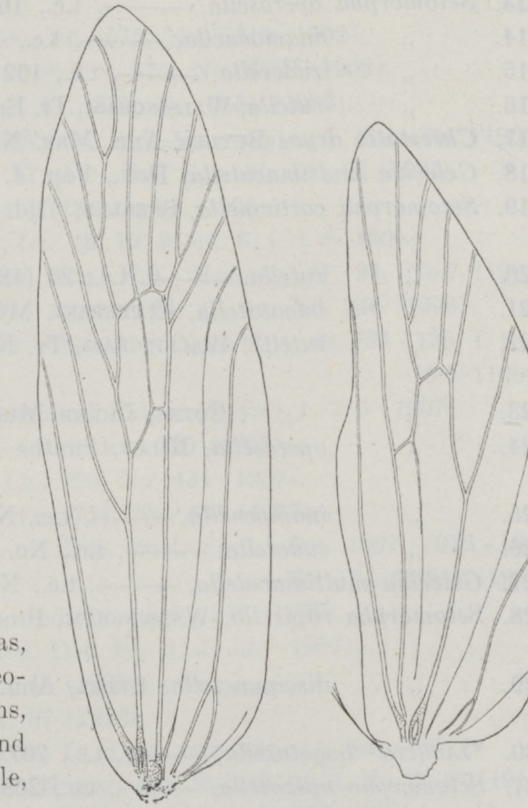

Fig. 3. Wing neuration in female (18 ×).

Hindwings nearly as broad as, or narrower than forewings, lanceolate, apex pointed. 8 veins or 7 veins, vein 4 being sometimes absent; 3 and 4 connate in male, separate in female, 5 and 6 connate or stalked.

Note: We have not seen a single male of *S. rutella* Z. from the Netherlands East Indies, in which vein 4 in forewings was present (see fig. 2).

Setomorpha rutella ZELLER.

nec *insectella* (FAB.) WALS.; **synon. nov.** *margalaestriata* KEUCH., ♂, ♀.

1. *Setomorpha rutella,* ZELLER, Lepid. Micropt. Caffr., 94 - 95 (1852).
2. „ „ , ———, Hndl. Kngl. Vet.-Ak. *1852,* 94 - 95 (1854).
3. „ *rupicella,* ———, Lepid. Micropt. Caffr., 95 - 96 (1852).
4. „ „ , ———, Hndl. Kngl. Vet.-Ak. *1852,* 95 - 96 (1854).
5. „ *rutella,* WALKER, Cat. Lep. Br. M. *29,* 708 (1864).
6. „ „ , ZELLER, V.H.Z.-B. Ges. Wien *23,* 223 (1873).
7. „ *rupicella,* ———, t.c., 223 (1873).
8. „ *operosella,* ———, t.c., 223 - 224 (1873).
9. „ *inamoenella,* ———, t.c., 224 - 225 (1873).
10. „ *ruderella,* ———, t.c., 225 (1873).
11. „ *rutella,* ———, Hora Soc. Ent. Ross. *13,* 206 (1877).

12. *Gelechia multimaculella* CHAMBERLIN, Bull. U.S. GG. Surv. *4,* 89 - 90, 145 (1878).
13. *Setomorpha operosella,* ———, t.c., 162 (1878).
14. „ *inamoenella,* ———, t.c., 162 (1878).
15. „ *ruderella,* ———, t.c., 162 (1878).
16. „ *rutella,* WALSINGHAM, Tr. Ent. Soc. Lond. *1881,* 274, 287 (1881).
17. *Chrestotes dryas* BUTLER, Ann. Mag. N.H. (5 s.) *7,* 401, No. 39 (1881).
18. *Gelechia multimaculella,* HGN,, Pap. 4, 99 (1884).
19. *Setomorpha corticinella,* SNELLEN, Tijd. v. Ent. *28,* 24 - 25, No. 10, pl. 2, f. 12 ♂, 15 ♀ (1885).
20. „ *rutella,* ———, t.c., 24 (1885).
21. „ *bogotatella,* ALPHERAKI, Mém. Lep. *5,* 231, No. 55 (1889).
22. „ *rutella,* WALSINGHAM, Tr. Ent. Soc. Lond. *1891,* 81 - 82, pl. *7,* f. 73 ♀ (1891).
23. „ „ , COTES, Indian Mus. Notes *2,* 9 - 10 (1891).
24. „ *operosella,* RILEY, Smiths List Lep. Bor.-Am. 96, No. 5134 (1891).
25. „ *inamoenella,* ———, t.c., No. 5135 (1891).
26. „ *ruderella,* ———, t.c., No. 5136 (1891).
27. *Gelechia multimaculella,* ———, t.c., No. 5414 (1891).
28. *Setomorpha rupicella,* WALSINGHAM, Proc. Zool. Soc. Lond. *1891,* 511, 544, No. 48 (1892).
29. „ *discipunctella,* REBEL, Ann. K.K. Hofmus. *7,* 267 - 268, 283, No. 46, pl. 17, f. 16 ♀ (1892).
30. **Lindera* bogotatella,* ———, t.c., 267 - 268, 283, No. 47 (1892).
31. *Setomorpha operosella,* ———, t.c., 268 (1892).
32. „ *rutella,* ———, t.c., 268 (1892).
33. „ *corticinella,* ———, t.c., 268 (1892).
34. „ *rutella,* COTES, Indian Mus. Notes *2,* 164, No. 152 (1893).
35. „ *discipunctella,* REBEL, Ann. K.K. Hofmus. *9,* 17, No. 159 (1894).
36. **Lindera* bogotatella,* ———, t.c., 17, No. 160 (1894).
37. *Setomorpha bogotatella,* ———, WHITE, Butterfl. & Moths Tenerife 95, No. 19 (1894).
38. „ *discipunctella,* REBEL, Ann. K.K. Hofmus. *11,* 122 - 123, 146, No. 175 (1896).
39. „ *rutella,* ———, t.c., 123 (1896).
40. **Lindera* bogotatella,* ———, t.c., 146, No. 176 (1896).
41. *Setomorpha rupicella,* WALSINGHAM, Proc. Zool. Soc. Lond. *1897,* 168, No. 281 (1897).
42. „ *discipunctella,* REBEL, Ann. K.K. Hofmus. *13,* 377, 381, No. 189 (1899).
43. **Lindera* bogotatella,* ———, t.c., 381, No. 190 (1899).
44. *Setomorpha discipunctella,* STAUDINGER-REBEL, Cat. Lep. Pal. *2,* 233, No. 4494 (1901).

45. *Plutella (?) multimaculella*, BUSCK, J. N.-Y. Ent. Soc. *10*, 97 (1902).
46. „ „ „ , DYAR, Bull. U.S. Nat. Mus. *52*, 492, No. 5509 (1902).
47. *Setomorpha operosella*, ———, t.c., 575, No. 6549 (1902).
48. „ *inamoenella*, ———, t.c., 575, No. 6550 (1902).
49. „ *ruderella*, ———, t.c., 575, No. 6551 (1902).
50. „ *rutella*, DE NIÉCEVILLE, Ind. Mus. Notes *5*, 201 - 202 (1903).
51. „ „ , DIETZ, Tr. Am. Ent. Soc. *31*, 14 - 15 (1905).
52. *Semiota operosella*, ———, t.c., 18 - 19, 91 (1905).
53. „ *inamoenella*, DIETZ, t.c., 18, 19, 91 pl. 6, f. 4 ♂ (1905).
54. **Lindera* bogotatella*, REBEL, Ann. K.K. Hofmus. *21*, 24, No.7 (1906).
55. *Setomorpha discipunctella*, ———, t.c., 24, 40, 44, No. 246 (1906).
56. „ *operosella*, BUSCK, Proc. U.S. Nat. Mus. *30*, 734 - 735, f. 9 ♂ - 10 ♀ (1906).
57. „ *rupicella*, WALSINGHAM, Fauna Hawaii *1*, 726 (1907).
58. „ *discipunctella*, ———, t.c., 726 (1907).
59. „ *dryas*, ———, t.c., 726, No. 434 (1907).
60. „ *rutella*, ———, t.c., 754, No. 434 (1907).
61. „ *insectella*, ———, Proc. Zool. Soc. Lond. *1907*, 1016 - 1019, No. 154 (4494) (1908).
62. „ *rutella*, LEFROY, Ind. Ins. Life, 540 (1909).
63. *"tabaksmot"*, DE BUSSY, Med. Deli Pr. st. *1*, 129 (1907).
64. „ , ———, l.c., *3*, 45 (1909).
65. „ , ———, l.c., *4*, 57 (1910).
66. *Setomorpha rutella*, MEYRICK, Tr. Linn. Soc. (2), *14*, 302 (1911).
67. „ *dryas*, FULLAWAY, Hawaii Agr. Exp. St. Bull. No. *27*, 20 (1912).
68. „ *insectella*, MORSTATT, Der Pflanzer *9*, 288 (1913).
69. „ „ , ———, Beiheft z. Pflanzer *10*, 32 (1914).
70. *"tabaksmot"*, KEUCHENIUS, Med. Besoek. Pr. st. No. *19*, 18 - 23, f. 1, 2, 3 (1915).
71. „ , VAN HALL, Med. Lab. Pl.zktn No. *20*, 33 (1916).
72. „ , DE BUSSY, Med. Deli Pr. st. *9*, 120 (1916).
73. „ , VAN HALL, Med. Lab. Pl.zktn No. *29*, 31 (1917).
74. „ , HONING, Med. Deli Pr. st. *10*, 59, 172 (1917).
75. „ , JENSEN, Med. Pr. st. Vorst. Tab. No. *30*, 1 - 29 (1917).
76. *Setomorpha margalaestriata*, KEUCHENIUS, Med. Besoek. Pr. st. No. *26*, 21 - 26 (1917).
77. „ *rutella*, MEYRICK, Exot. Microlep. *2*, 84 (1917).
78. „ *sp.*, VAN HALL, Med. Lab. Pl.zktn No. *33*, 33, 34 (1918).
79. „ *margalaestriata*, ROEPKE, Med. Pr. st. Midd. Java No. *32*, 13 - 14 (1918).
80. *Trisyntopa euryspoda*, LOWER, Tr. R. Soc. S. Austr. *42*, 238 - 239 (1918).
81. *Setomorpha margalaestriata*, DEN DOOP, Med. Deli Pr. st. (2), No. *3*, 7 - 18 (1919).

82. *Setomorpha margalaestriata*, VAN HALL, Med. Lab. Pl.zktn No. *36*, 46 (1919).
83. „ *tineoides*, DAMMERMAN, Landb. dierk. Ned. Ind., 205 (1919).
84. „ *insectella*, FLETCHER, Proc. 3d Ent. Meet. Pusa, 856 (1919).
85. „ „ , ———, Mem. Dept. Agric. India, *6*, 188 - 189 (1920).
86. *"tabaksmot"*, VAN HALL, Med. Lab. Pl.zktn No. *39*, 48 (1920).
87. *Setomorpha margalaestriata*, JENSEN, Ziekten Tabak, 113 - 118, f. 26 - 30, pl. 48, 49 (1921).
88. *"tabaksmot"*, VAN HALL, Med. Lab. Pl.zktn No. *46*, 48 (1921).
89. *Setomorpha insectella*, PAYNE, J. Econ. Ent. *18*, 224 - 227 (1925) erroneous!
90. „ *rutella*, GATER, Mal. Agr. J. *13*, 160 (1925).
91. „ „ , HARGREAVES, Rept. Dept. Agr. Uganda *1926*, 24 - 27 (1927).
92. „ , VAN DER GOOT, Med. Lab. Pl.zktn. No. *74*, 82 (1928).
93. „ *sp.*, LEEFMANS, l.c. No. *75*, 92 (1929).
94. „ *tineoides*, DAMMERMAN, Agric. Zoology Mal. Arch., 257 (1929).
95. „ *insectella*, FLETCHER, Mem. Dept. Agr. India *11*, 203 (1929).
96. *Semiota inamoenella*, ———, t.c., 202 (1929).
97. *Epilegis cariosella*, ———, t.c., 81 (1929).
98. *Apotomia fractiliniella*, ———, t.c., 231 (1929).
99. *Trisyntopa euryspoda*, ———, t.c., 231 (1929).
100. *Setomorpha margalaestriata*, KUIJPER, Med. Deli Pr. st. (2), No. *60*, 38 (1929).
101. „ „ , PATTON., Insects etc. of Medical Importance, 535 - 536 (1931).
102. „ *tineoides*, ULTÉE, Med. Pr. st. Malang No. *80*, 49 (1931).
103. „ *insectella*, RITCHIE, Rept. Dept. Agr. Tanganyika *1934*, 73 - 83 (1935).
104. „ *rutella*, LEEFMANS, Med. Inst. Pl.zktn No. *82*, 89 (1934).
105. „ „ , VAN DER MEER MOHR, Med. Deli Pr. st. (2), No. *81*, 80 - 83, f. 8, pl. 33, f. 1, 2 (1932).
106. „ „ , ———, l.c., No. *91*, 22 (1935).
107. „ „ , VAN DER GOOT, Med. Inst. Pl.zktn No. *85*, 91 (1935).
108. „ *nitella* (lapsus), VOÛTE, l.c., No. *86*, 19 (1935).
109. „ *insectella*, VAN DER MEER MOHR, Bull. Deli Pr. st., No. *35*, 39 (1935).
110. „ *margalaestriata*, ———, t.c., 39 (1935).
111. „ *rutella*, ———, t.c., 39 (1935).
112. „ *tineoides*, ———, t.c., 39 (1935).
113. „ *rutella*, ———, Med. Deli Pr. st. (2), No. *93*, 20 (1936).
114. „ „ , ———, l.c., No. *96*, 20 (1937).
115. „ *drys*, COTTON & GOOD, U.S. Dept. Agr. Miscell. Publ. No. *258*, 59 (1937).
116. „ *inamoenella*, —— & ——, t.c., 59 (1937).

ERRATUM.

Pag. 409 (Note) line 10 to read:

Note: As a base for this list of synonyms we have used the list given by WALSINGHAM (61) up to No. 61 and completed it from No. 62 on to the end.

117. *Setomorpha margaloestriata* (sic), COTTON & GOOD, t.c., 31, 59, No. *185* (1937).
118. „ *operosella,* —— & ——, t.c., 59 (1937).
119. „ *ruderella,* —— & ——, t.c., 59 (1937).
120. „ *rutella,* KALSHOVEN, Landbouw, *14,* 101, 109 (1938).
121. „ *margalaestriata,* ———, t.c., 109, 110 (1938).
122. „ *insectella,* ———, t.c., 109 (1938).
123. „ *tineoides,* ———, t.c., 109 (1938).
124. „ *rutella,* VAN DER LAAN, Med. Deli Pr. st. (2), No. *98,* 15 (1938).

Note. As a base for this list of synonyms we have used the list given by WALSINGHAM (54).

Diagnose of Setomorpha rutella Z.

♂ 8 - 11 mm (fig. 1), ♀ 12 - 22 mm.

A n t e n n a e 3/4, smooth, or hardly pubescent in male.

Fig. 4. Head of imago, front view (34 ×).

H e a d (fig. 4 and 5) varying from greyish-brown or brownish to brownish-ochreous, with tips of scales lighter; face lighter, brownish-ochreous; eyes black.

L a b i a l p a l p i with first and second joint dark brownish, the apex of second joint whitish-ochreous, its apical half with ochreous scales beneath; third joint light brownish-ochreous, at the outer side some scattered brown scales. The palpi are lighter at the inner side: greyish-ochreous.

T h o r a x greyish-ochreous or ochreous mixed with brownish.

F o r e w i n g s with costa little arched at base, then nearly straight, beyond the middle of wing gently arched to apex; apex acute; termen arched, very oblique, tornus indefinite. Greyish-ochreous, brownish-ochreous or light ochreous, mixed with brown. Markings rather variable, sometimes indefinite and suffused with scattered dark scales. Marginal dots: a distinct row along costa, these dots being rounded in male; in female rounded on anterior half of costa; on posterior half about 4 large triangular dots; a row of dots along termen; in tornus and on posterior half of dorsum also distinct rounded dots, from which start rows of dark scales, forming some dark fasciae on cilia; discal dots: about three longitudinal rows, the first row above middle of wing being only distinct. Sometimes the dots are confluent, forming three dark spots: one before middle, one at ¾ and one subapical; the latter being most distinct. The first two spots are in dark specimens connected with dark suffusion on dorsum; in light specimens only marginal and a few discal dots remain. Cilia brownish-ochreous, with scattered dark scales, as described above.

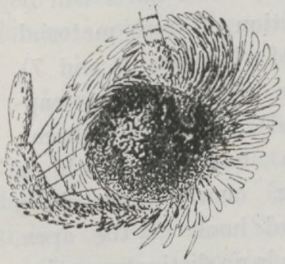

Fig. 5. Head of imago, lateral view (34 ×).

H i n d w i n g s greyish-ochreous or light ochreous, glossy, cilia lighter, greyish-ochreous. Underside of wings brownish-ochreous, that of the hindwings lighter.

A b d o m e n smooth-scaled, greyish-ochreous or ochreous.

L e g s: fore and middle pair dark brown, with light ochreous articulations; a light ochreous ring on middle of fore and middle femur and of fore and middle tibia; hindlegs ochreous, tarsus brownish, with light rings.

Genital Characteristics.

The genital apparatus, which is described below, was studied by boiling up the entire abdomen in 10 % caustic potash; afterwards the genitalia were prepared under a dissecting microscope, studied in 70% alcohol and mounted in Venetian turpentine, in the way formerly described [1]). The female internal genital organs in this species seem to be of a very delicate nature, as we did not succeed in following them, in spite of many mounts having been made: the bursa for instance seems to be dissolved when macerating. The only way to study these parts will be dissection of fresh material.

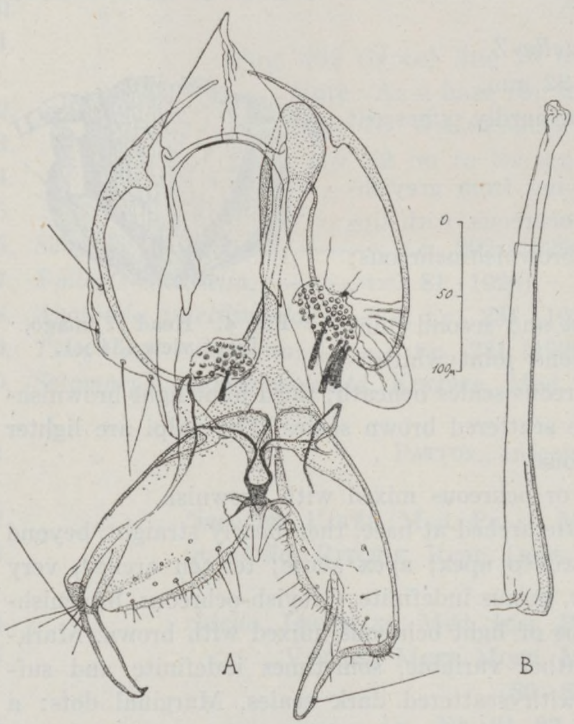

Fig. 6. Male genital apparatus. A. View from behind, valvae pushed away from each other and bent down, saccus curved dorsally. B. Penis, lateral view. (Praep. No. 1, cotype-specimen of *corticinella* SN. /Leyden Museum/).

M a l e (figs. 6 and 7). Uncus absent. (Anus cap-shaped). Gnathos absent. Valva concave. With a strong, curved and sharp pointed hook at the apex. There is no distinct sacculus. Costa well developed, its margin folded inwards, forming a bag drawn into an ear-shaped projection, the valvula. Anellus strong. Transtilla absent. Tegumen π-shaped, a transverse rod and two vertical rods, dilated beneath; these vertical rods have a projection halfway the inner side. Saccus long, spoon-like. Aedoegus long, straight, vesica unarmed, cornuti being absent. The 8th abdominal segment is edged by a thin, chitinous rod, its basal, unpaired curve lying under the saccus, when this is drawn in into the resting position; its ends are

[1]) A. DIAKONOFF, Notes on Microlepidoptera, Temminckia 2, 189 (1937).

curved dorsally, pointed, dilated subapically to a knob. One pair of coremata, which are well developed and form large extensible pencils of long, dark brown scales. (Number of mounts studied: 7).

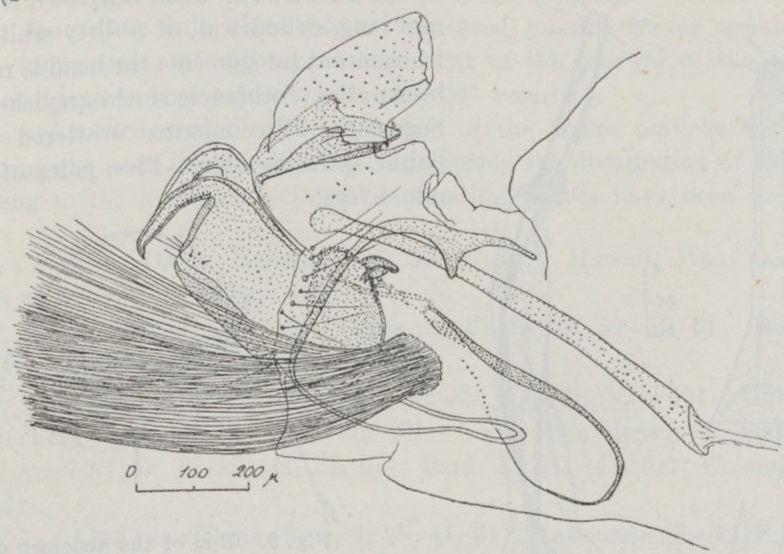

Fig. 7. Male genital apparatus, lateral view; in natural position. (Praep. No. 19, type-specimen of *rutella* Z. /Stockholm Museum/).

F e m a l e (fig. 8). Ovipositor very long, an area of minute verrucae and two pairs of bristles halfway its length; beyond these a violently folded, longitudinally striped area; the apex bilobed, bristled. Ostium genitale narrow, funnel-shaped. (Number of mounts studied: 7).

TYPE: ♂ and ♀ *rutella* ZELLER: ♂ and ♀, Stockholm Museum; ♀ Brit. Museum; *corticinella* SNELLEN: cotypes ♂ and ♀, Leyden Museum; *margalaestriata* KEUCHENIUS: cotypes ♂ and ♀, Besoeki Exper. Station, Java.

Life history.

The life history of *Setomorpha rutella* Z. was first described by KEUCHENIUS (70), afterwards completed by this author (76), and also by JENSEN (87), from observations made in East Java. In British India its life history has been studied by FLETCHER (85); in this country it does not differ from that on Java.

The egg is 0,25 - 0,54 mm long and 0,17 - 0,27 mm broad, pearlwhite, changing into brown before hatching. According to FLETCHER they are laid singly, but KEUCHENIUS reports that they are laid in groups as well, sticking to the substrate.

An interesting note on oviposition is given by FLETCHER: "Before depositing an egg the female extrudes her ovipositor for about 2 mm and moves it from side to side, then raises it upwards between the wings and then with a jerk deposits an egg at the utmost reach of the ovipositor, and then moves to another place to lay another egg."

KEUCHENIUS records 143 eggs from one female. The eggs hatch after 7 - 8 days, the young larvae being about 1,25 mm long, with a light brown head.

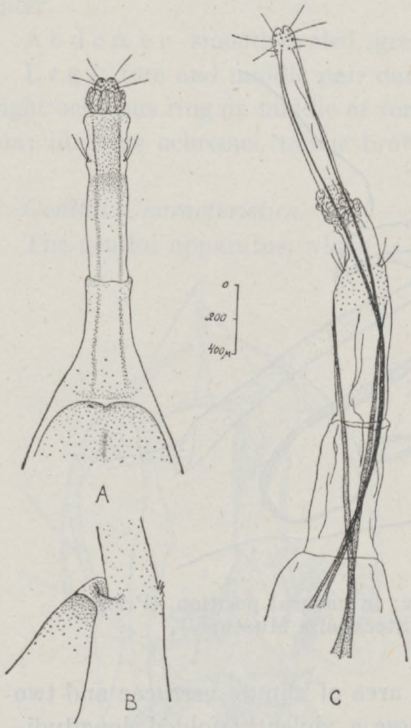

Fig. 8. Female genital apparatus (pro parte). A. Ventral view of the ostium genitale and the ovipositor partially extruded. B. Lateral view of the ostium genitale. C. Ventral view of the ovipositor almost entirely extruded. (A and B. praep. No. 75 /Coll. Inst. Plant Des., Buitenzorg/, C praep. No. 24 /Coll. Colon. Institute, Amsterdam/).

T h e l a r v a when fullgrown is 15 - 17 mm long, cylindrical, of a dirty white, with transparant integument; the head is reddish-brown, the prothoracic shield greyish-brown. Segments with minute, scattered brown hairs; spiracles black. Five pairs of abdominal legs.

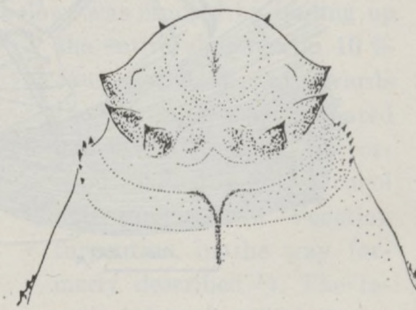

Fig. 9. End of the abdomen of pupa (20 ×).

T h e p u p a is about 6 mm (♂), 7 - 9 mm (♀) long, cylindrical, light brown anteriorly, whitish posteriorly. The 5 first abdominal segments bear on the dorsal side each two bands of thorns: one band along the foremost segmental margin, formed by 2 - 3 irregular rows of short thorns, and one band on the hind margin, consisting of one row of more regular, littler thorns; from the 6th to the 8th segment this hind band is lacking. Typical is a crown of 8 sharp pointed knobs at the end of the 8th segment (this part is figured by JENSEN, 87, p. 115, f. 28; our fig. 9). The pupation takes place in a tight and smooth, cylindrical, white cocon, covered with a few food fragments and excrements of the larva loosely spun together (fig. 10).

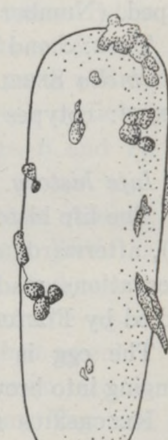

Fig. 10. Cocoon (7 ×).

Distribution and feeding habits.

Setomorpha rutella Z. has a circumtropical distribution and is polyphagous. It has been found in a great number of various animal and vegetable materials. Of great economic importance is its predilection for dried tobacco leaves in the Netherlands East Indies, where, as has been said

above, in the time of the Great War large quantities of this product were stored. In that period this species was recorded as very injurious in Sumatra, as well in Java. The eggs were deposited in the slits and meshes of tobacco bales and after a short time only the veins of the cured tobacco leaves remained. By drastic fumigation and still more on account of the renewal of the export of tobacco, this pest was reduced to occassional returns.

As a knowledge of the feeding habits of the larvae may be of value in combating the pest, in the following list, showing the distribution of the species according to the available records, the breeding places have been included.

Hawaiia: Oahu: Honolulu (17, 59, 61, 67); Hawaii: Kaawaloa Kona, 1500 ft. VI (59, 61); *in corn* (67).

N. America (U.S.) (110): Texas (8 - 10, 18, 46, 52 - 53, 61); Bosque Co (12); Waco (18, 61); Kansas (52, 61).

C. America: Mexico: Guerrero, Amula, 6000 ft., VIII (61); Guatemala: Balheu, Vera Paz (61); San Geronimo (61); Costa Rica: Irazu, 6 - 7000 ft. (61).

S. America: Brazil (41, 57, 61); Pará, X-XII (41, 61); Colombia: Bogotá (61).

West Indies: Cuba (3 - 4, 7, 28, 41, 61), Havannah (3 - 4, 28, 41, 61); Jamaica, Moneague, 5.I.1905 (61); Runaway Bay 23.II.1905 (61).

Canaries: Tenerife (21, 29 - 30, 35 - 38, 40, 42 - 44, 54 - 55, 61); Santa Cruz XII.1897 (42, 61), 8-31.I.1907; Guimar 6.III - 18.IV.1907; Puerto-Orotava 1896, 11.III.1904 (61); 12.IV.1895 (38, 61); Agua Mansa, 30.VII.1889 (29, 61).

Africa: Sierra Leone, ⊕ *in moss*, excl. 24.VIII - 13.IX.1895 (61); Gold Coast, Accra (61); Congo: Kasongo, ⊕ *in muscular fibre on scull of Hippopotamus*, excl. 18.IX.1905 (61); Caffraria (1 - 2): Limpopo-Gariep (11, 61); Uganda: *in bulbes* from the Seychelles (91); *in maize seed* (67), *in old cotton seed* (68, 69) *in Pennisetum seed, in mhogo, in coffee seed, in crude rubber* (69); intercepted *in coffee seed* from Belgian Congo (103); Seychelles Isl., Mahé, Cascade Estate, 1000 ft. and Port Victoria in I and II (66).

Asia: India (23, 34, 50, 61 - 62, 84 - 85, 95): Calcutta (23, 34), Aliwal (50, 61, 85), *in blanketting*, excl. 20 - 29. XII. ⊕ Ceylon, *"bred from moths* received from Ceylon" excl. 15.XI.1899 (61, 85). Assam, Margherita, 1889 (61, 85). Pusa, Rangpur, Coimbatore, Darjiling, Mercara, Pollibetta, Nagpur (84 - 85), *in dry tobacco leaves* (62, 85), *on stored Coriander seed, on Setaria italica grain in store, on wheat flour, on Dolichos biflorus* (*seeds* ?), *on bean* (*in store* ?) (85); Kuala Lumpur, *in Brazil nuts* (*Bertholletia excelsa*) (90).

Sumatra: Deli, *in cured tobacco leaves* (64 - 65, 71 - 74, 76, 79, 87, 92 - 93, 100, 105 - 106, 111, 113 - 114, 120 - 124) [⊕ 30.I.1932 and 14.II.1936, VAN DER MEER MOHR] *); *in Carum-seeds* (74); *in market coffee* (120) [⊕ 7 and 14.XI.1931, A.V.R.O.S. Exp. Stat.] *).

*) The specimens placed between [ ] have been examined in the present study.

J a v a: *in cured tobacco leaves* (83, 94, 111, 120 - 123): *in the same material* in: Besoeki, Djember (70, 71, 73, 76, 78, 82, 86 - 88); do in: Vorstenlanden, Klaten (75, 78, 82, 104) [3.VI.1935, Dr. THUNG] *), *in tobacco seed, under kadjang mats, in lining of tropical hats,* [1]) *in wool* [1]), *leather, old rags* [1]), *clotches* [1]), *maize, sunflower seeds, seeds of some green manures, press cake* (*boengkil*) [1]) (70, 76), *in Coca seeds* (68, 74, 102); *in Citrus seeds* (108) [Malang, 10.IV.1925, Dr. VOÛTE] *).

[In the Leiden Museum: Batavia; Preanger, 5000 ft SIJTHOFF; Tegal, Kemanglen, *in bees nest,* LUCAS; Pekalongan VAN DEVENTER; Java, *on bird skins* 15.VI.1880, SW; Java occ., HEKM. From the collection of the Institute for Plant Diseases, Buitenzorg: Telawa, Teak forest, ⊕ in *birds excrements,* excl. 3 and 13.VII.1936 (Dr. KALSHOVEN). Buitenzorg, ⊕ *white onions,* 4.II.1938 (Dr. KALSHOVEN); ⊕ *plant bulbs* from Netherlands, 29.IX.1933 (Ir. WATERSCHOOT); ⊕ *Hyacinth bulbs* from Netherlands, IV.1933 (Ir. WATERSCHOOT). Mount Gedé ⊕ *Galls of Uromicladium tepperianum on Albizzia montana,* 18 - 23 - 29 - 30.VII, 3 - 8 - 11.VIII.1932 (Dr. KALSHOVEN)].

C e l e b e s: Makassar, Maros, Saleyer Isl., (19, 33, 61). [In the Leiden Museum: same localities, ♂ and ♀ cotype specimens of *corticinella* SN., PIEPERS] *).

P h i l i p p i n e s: *in cured tobacco* (112).

A u s t r a l i a: Queensland, Toowong, 1896 (61): New South Wales, Broken Hill, X (80, 99).

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*) See page 413.

[1]) With reference to these record of foodstuffs for Setomorpha mentioned by KEUCHENIUS, Dr KALSHOVEN informs us, that as no labeled specimens in support of them are available, those records must be considered as rather doubtful, the more so as from the lining of a tropical hat, an unidentified moth, from woollen manufactures *Tinea pellionella* L. and from boengkil presscakes the very common *Ephestia cautella* WLK. have been reared by him. The larval workings of these species can be readily confused with those of *Setomorpha rutella,* according to our informant.

FISH EGGS AND LARVAE FROM THE JAVA SEA [1])

by

Dr. H. C. DELSMAN.

(Laboratorium voor het Onderzoek der Zee, Batavia)

24 MYCTOPHOIDEA.

In "Die Fische der Siboga-Expedition" and again in "The fishes of the Indo-Australian Archipelago", vol. II WEBER (1913) shows a few fish larvae and young fishes identified by him as belonging to species of the genera *Saurus* (*Synodus*) and *Saurida*. They are characterized by a longitudinal shape reminding us of clupeid larvae with which they agree also by the backward position of the anus. Further they may be easily recognized by a series of black pigment patches along the ventral surface. These patches are paired in the trunk region whereas in the tail a single one is present on the ventral side. The number of paired patches in the trunk region varies according to the species.

SANZO (1915) has figured a series of larvae belonging to the atlantic *Synodus saurus* and showing the same black pigment spots.

TAKAYUKI KAMYA (1916 and 1925) has reared similar larvae, identified by him as *Synodus* spp. from pelagic eggs characterized by a network of fine hexagonal ridges on the surface of the egg membrane. Unfortunately I cannot read his paper which is written in the japanese language.

In 1935 J. B. NORMAN published "A revision of the Lizard-fishes of the genera *Synodus, Trachycephalus* and *Saurida*" in which also the known larvae are mentioned and figured.

In the Java Sea pelagic eggs with a network of fine hexagonal meshes on the surface of the egg-membrane are not rarely found in the catches. They may evidently belong to very different species of fishes, as is the case in more northern waters where e.g. *Callionymus lyra* as well as *Synodus* spp. have such eggs. The type of egg we have to confine us to in this paper is characterized by the absence of an oilglobule, and by the absence of other than small black pigment spots in the unhatched embryo. I believe I have distinguished two varieties but possibly there may prove to be more, differing slightly in diameter and in the size of the hexagonal meshes on the egg-membrane. Evidently they belong to species of *Saurus* and (or) *Saurida*. This tallies also with the observation made by RAFFAELE as early as 1888, viz. that the ovarial eggs of *Saurus lacerta* have an egg membrane showing a similar structure (l.c. p. 28).

[1]) cf. Treubia Vol. II, p. 97, Vol. III, p. 38, Vol. V, p. 408, Vol. VI, p. 297, Vol. VIII, p. 199 and p. 389, Vol. IX, p. 338, Vol. XI, p. 275, Vol. XII, p. 37 and p. 367, Vol. XIII, p. 217 and p. 401, Vol. XIV, p. 109 and p. 237.

A common egg of this type is the one shown in fig. 1. The diameter is 1,1 - 1,2[5] mm, the whole egg colourless and very transparent, without pigment and without oil-globule. Unlike in clupeoid and eel eggs the yolk shows no segmentation. The egg of fig. 1 was taken at 11.30 a.m. and drawn at 2 p.m., July 28th, 1921. It shows a small germinal disc. In this stage a clupeid egg could hardly be older than from the same morning but we will see that in the present egg development proceeds slower, so that it seems quite possible that spawning had taken place the night before. More than 50 eggs of this kind were taken together in this haul with the egg net, between the southernmost of the Thousand Islands, north of Batavia.

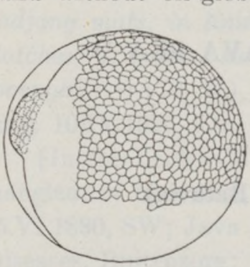

Fig. 1. Egg *a*, fished July 28th, 1921, between Pulu Pandjang and Pulu Babi (southern Thousand Islands), drawn about noon, × 26.

Development proceeds relatively slowly. The next morning the yolk had not yet completely been grown round by the germinal disc (as is the case with clupeid eggs in the course of the first day already). Fig. 2 shows the egg at July 31th, 6.45 a.m. In the afternoon of that day the heart was seen beating and the next day, August 1st, the larvae hatched. Incubation therefore took about 3½ days, whereas an egg of this size of a herring-like fish would, in Indian waters, not have taken fully 24 hours for hatching. Unlike most other pelagic fish eggs in the Java Sea the present eggs are often fished accordingly showing different stages of development at the same moment, evidently one, two, and three days old.

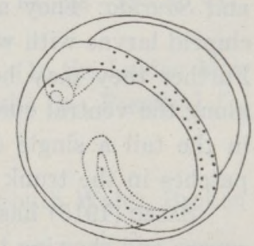

Fig. 2. Same egg at July 31th, 6.45 a.m., × 26.

The newly hatched larva is shown in fig. 3. In several respects it reminds us of a herring or anchovy larva, the main difference being that the yolk is not segmented. We note the same elongated shape, the high number of myotomes, and the relatively backward position of the anus. The latter is found under the 35th myotome, whereas in the tail some 15 - 20 myotomes could be counted. The muscle fibres in the myotomes show a similar crossed arrangement as we have regularly found in the eggs of all kind of herring- and anchovy-like fishes (cf. Treubia III p. 40, VI p. 299, VIII p. 225 etc.). A number of small black pigment spots in scattered all over the surface of the body. The rudiment of the pectoral fin is present.

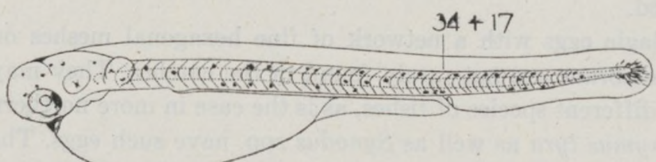

Fig. 3. Newly hatched larva, Aug. 1st, 6.30 a.m., × 26.

During further development the pigment concentrates into a number of black dots situated just under the ventral border of the myotomes. Four pairs of these are present in front of the anus, one unpaired on the underside of the tail. Also the

tip of the tail contains some pigment. The day after hatching the eyes have grown black. The number of myotomes in fig. 4 is again 35 + 15 - 20 = 50 - 55.

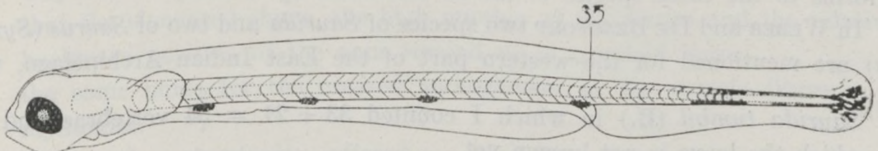

Fig. 4. Larva with black eyes, Aug. 3rd, × 26.

Besides the egg described above I have regularly found in the catches a slightly smaller one of the same type (fig. 5), the diameter being about 1 mm. The hexagonal meshes are finer than with the foregoing egg. The newly hatched larva has 39 - 40 prae-anal myotomes, whereas some 17 more could be counted in the tail. In slightly further advanced stages I counted 8 pigment spots between the pectoral fin and the anus, and one on the underside of the tail. Larvae provided with a series of black pigment spots and evidently

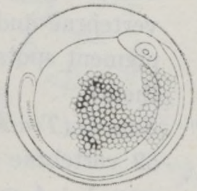

Fig. 5. Egg *b*, fished Dec. 12th, 1920, north of Bantam Bay, × 26.

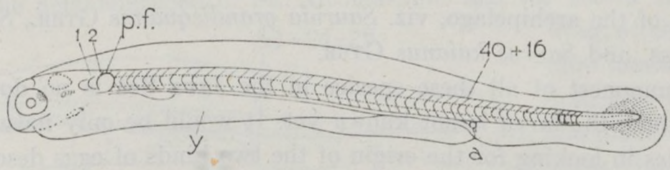

Fig. 6. Newly hatched larva, Dec. 13th, × 26. *a.* anus, *p.f.* pectoral fin, *y.* yolk.

belonging to the genera *Saurus* and *Saurida* are not rarely found in the catches of the egg net. The number of black patches, however, may vary considerably.

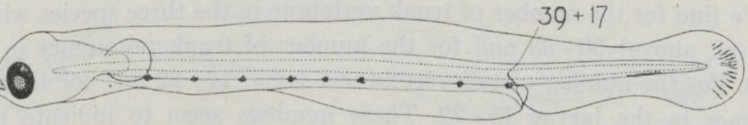

Fig. 7. Slightly older larva, Dec. 14th, × 26.

A larva as represented in fig. 8 seems to me to belong to the latter of the two eggs described above, the number of paired pigment patches being equally 8 and that of the myotomes 40 + 17 - 18.

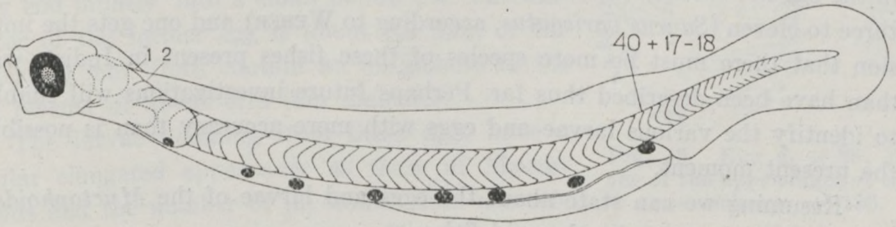

Fig. 8. Pelagic larva caught in egg-net, × 26.

We have, then, reared from pelagic eggs two types of larvae, one with 4 paired pigment spots in front of the anus, one with 8 pairs. None of these two conforms to the three species of larvae identified by WEBER.

In WEBER and DE BEAUFORT two species of *Saurida* and two of *Saurus* (*Synodus*) are mentioned for the western part of the East Indian Archipelago, viz.

1° *Saurida tumbil* (B.) in which I counted 33 + 21 = 54 vertebrae and of which the larva is not known yet.

2° *Saurida gracilis* (Q.G.) = *nebulosa* C.V. in which I counted 30 + 17 = 47 vertebrae and of which the larva according to WEBER has 7 pairs of black pigment spots in front of the anus (2 in front of the ventral fins, 5 behind them).

3° *Saurus* (*Trachynocephalus*) *myops* (BL. SCHN.), in which I counted 30 + 22 = 52 vertebrae and of which the larva according to WEBER has in the same way 1 + 4 = 5 pairs of black pigment spots.

4° *Saurus variegatus* (LAC.) of which I do not know the number of vertebrae and of which the larva according to WEBER has 2 + 9 = 11 pigment spots.

Besides these 4 western species three more are mentioned only from the eastern half of the archipelago, viz. *Saurida grandisquamis* GTHR., *Saurus intermedius* AGASS. and *Saurus kaianus* GTHR.

The commonest of all these species in the Java Sea is no doubt *Saurida tumbil* of which the larva is not known yet. It would be only natural to think of this species in looking for the origin of the two kinds of eggs described above and which are so often found in the catches in the Java Sea. But which of the two kinds ought to be ascribed to *Saurida tumbil* is a question I don't venture to decide. And to which species then the other of the two would belong seems as uncertain.

We find for the number of trunk vertebrae in the three species which I could study (cf. above) 30 - 33 and for the number of trunk myotomes in the larvae 35 - 40. For the number of tail vertebrae I found 17 - 22 and for that of the tail myotomes in the larvae 15 - 20. These numbers seem to indicate that during development a decrease of the number of trunk vertebrae, i.e. a forward movement of the anus, takes place, in the same way as I found to be the rule with the clupeoid fishes.

A number of larvae evidently belonging to *Myctophoidea* are to be found in the egg net catches. The number of paired black pigment dots may vary from three to eleven (*Saurus variegatus*, according to WEBER) and one gets the impression that there must be more species of these fishes present in Indian waters than have been described thus far. Perhaps future investigations will enable us to identify the various larvae and eggs with more accuracy than is possible at the present moment.

Resuming we can state about the eggs and larvae of the *Myctophoidea* as compared to those of the clupeoid fishes:

1e that the yolk is very transparent, but not segmented as in clupeids.
2e that no other than black pigment dots develop, in the same way as with clupeids.
3e that the elongated shape, the high number of myotomes and the relatively backward position of the anus remind us of clupeoid larve.
4e the same holds for the crossed arrangement of the muscle fibres in the myotomes.

I seize the opportunity offered here to show and describe a few pelagic eggs of unknown origin but evidently belonging to species more or less related to the *Myctophoidea* and, more distantly, to the herring-like fishes. This is shown by the shape of the larvae hatching from them.

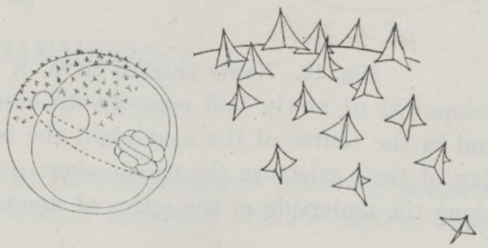

Fig. 9. Egg *c*, × 26; 9′ part of the surface of the egg-membrane, × 135.

There are two kinds of these eggs, not rarely occurring together in one haul. They were regularly found in the entrance from the Java Sea into Sunda Strait, in the neighbourhood of St. Nicolaaspunt and the isle of Dwars in den Weg, often in considerable numbers. The bottom here is sandy and the plankton often contains large amounts of echinopluteis. Both eggs mentioned are characterised by the peculiar design of the eggmembrane which bears on its surface a great number of short appendages giving it a prickly appearance. In the one case (fig. 9, 9′) these appendages, composed of three plains intersecting each other at angles of 120°, end indeed into a point. In the other egg (fig. 12, 12′) they end bluntly, into a small hollow pit. The diameter of the former egg is about 0,8 mm, of the latter 0,9 mm. Both contain an oil-globule in the egg plasma of about 0,18 mm diameter.

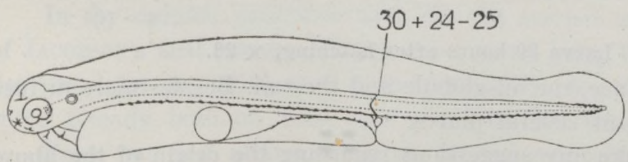

Fig. 10. Newly hatched larva, × 26.

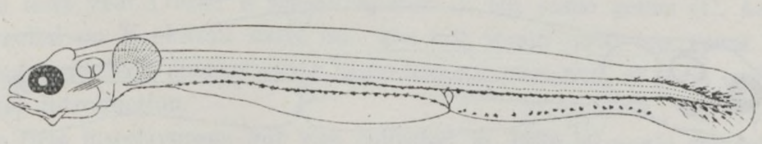

Fig. 11. Larva 3 - 4 days old, × 26.

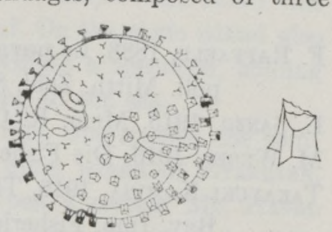

Fig. 12. Egg *d*, × 26; 12′ one of the appendages of the egg-membrane, × 135.

The larvae hatching from these eggs have a similar elongated appearance as those of Myctophoids and the number of myotomes does not differ much from that of the latter. The situation of the anus is slightly more

forward: in the larva of fig. 13 the nummer of myotomes is 32 + 24 = 25 and in that of fig. 10, 30 + 24 = 25.

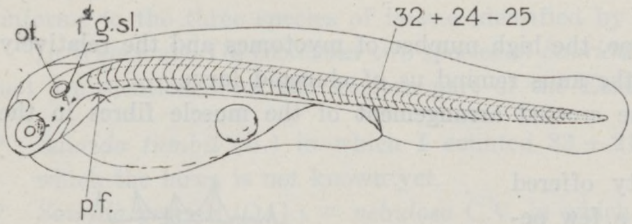

Fig. 13. Newly hatched larva, × 26.

The number of trunk myotomes, therefore, is lower, that of the tail myotomes higher than in the myctophoid larvae.

I cannot say how long incubation takes, as I have not followed the development of newly laid eggs. In all cases the eggs hatched during the night, and in the course of the next night the larvae got black eyes. During the first day of their existence the larvae show a long series of fine black pigment dots along the underside of the series of myotomes and along the gut, and scattered

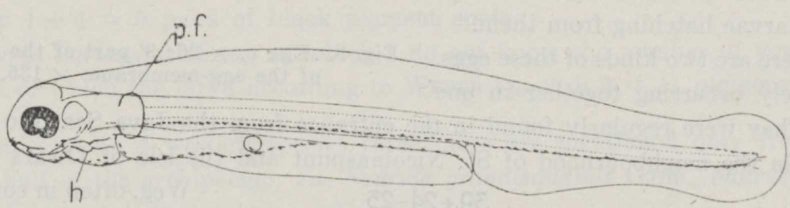

Fig. 14. Larva 20 hours after hatching, × 26.

similar black dots on the face, the oil-globule and the tail. Besides more diffuse yellow pigment is present at several places.

I don't venture to make any suggestions regarding the origin of the above eggs but have to leave it for my successors to make out, if possible, to which fishes they belong.

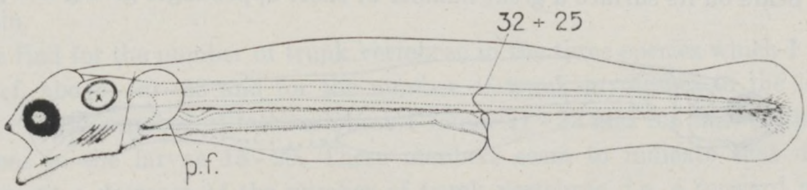

Fig. 15. Larva 55 hours after hatching, × 26.

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ON JALORENSIS-RATS AND OTHER MAMMALS FROM THE KRAKATAU ISLANDS.

By

Dr. K. W. DAMMERMAN

(Zool. Museum, Buitenzorg).

On the mammals discovered on the Krakatau Islands after the eruption of 1883 only some scattered notes have been published hitherto, but no comprehensive report has appeared.

No mammals were collected by JACOBSON in 1908 but as he did not use traps, he could not tell whether they were really absent. He mentioned, however, that during the three nights he stayed on the main island not a single bat was to be seen.

In my opinion mammals had not yet arrived on the islands at the time of JACOBSON's visit (except perhaps the rats on Lang Island), as the first species detected later on (1919) were bats (*Cynopterus brachyotis*) which were represented already both on Krakatau and Verlaten Island.

From our first arrival when we started our researches we often disturbed bats when strolling through the forest and they were frequently seen roosting in shrubs or low trees, so it seems probable that they arrived on the spot between 1908 and 1919.

The next year (1920) a second species of the same genus (*C. horsfieldi*) was detected on Krakatau itself but was not found until ten years later on Verlaten Island. This species seems to be less common and, at least on Verlaten I., a later introduction.

The first insectivorous bat was collected in 1928, a single specimen only of *Hipposideros diadema,* at an altitude of 600 m.

As late as 1933 a fourth species of bat (*Rousettus amplexicaudatus*) was discovered in a cave on the East coast of Lang Island. On the same island also a *Cynopterus* occurs as we saw (October 1933) at twilight a specimen, holding a fig-fruit in its jaws, dodging along the path running to the sea.

In addition to bats the islands are inhabited by rats. One species, the common house-rat (*Rattus r. diardi*), occurring on the main island of Krakatau, has certainly been introduced by human agency. When a certain Mr. HANDL settled on the island in 1917 they were not yet there, but soon after, in 1919, they were already a familiar sight and even a nuisance.

In 1924, when Mr. HANDL had left the island and his house had fallen into ruins, they seemed to have disappeared altogether as we were not able to catch

any although we set several traps each night of our sojourn. As the same time the large *Python* was found to be fairly numerous so we ventured to attribute the vanishing of the rats to the presence of these snakes or to their inability to hold their own when their usual habitat was no more.

This assumption, however, proved to be untenable as in January 1933 and the following year the species was again abundant and apparently had recovered from the blow received some ten years ago.

Another rat, also belonging to the *rattus*-group (*R. r. jalorensis*), the wide-spread Malay country-rat, was met with on Lang Island. It was already there and even plentiful in 1928 at the time the observation-post of the Volcanological Survey settled on the island, so it was certainly not introduced by this party.

Whether or at what time it has been imported by fishing-boats or arrived on the island by some other means must be left undecided. The supposition of the animal having survived the disaster of 1883 is hard to believe. Even if the species was not entirely exterminated by the eruption it could not possibly hold its own afterwards on an island covered with a layer of hot ashes of several metres thickness and destitute of all vegetation and nutriment. This species of rat is easily introduced as it is found even on the smallest islands and especially those which are uninhabited.

Other mammals besides bats and rats, have not yet been found, but in December 1933, when landing on the S.E. coast of Krakatau at a spot where fishermen sometimes pass a night on the island and have dug a well, we saw near the beach a small black dog, skinny and shy, which hurried off as soon as it got wind of us. Much to our surprise we found in April 1934, disembarking at the same spot, the fresh prints of a dog on the sands and in the evening the same black dog was seen roving about the shed of our coolies.

This noteworthy fact in the first place proves that pet animals are sometimes released or having run away are left behind by the owner, and in the second place that even domesticated animals can live a semi-wild life for several months on an uninhabited island like Krakatau.

This time it was a dog but next time it may be a monkey that is set at liberty, the common gray macaque being not rarely kept as a pet by fishermen.

In this connection we would call attention to an observation made by HICKSON, told in his book "A Naturalist in North Celebes" (1889, p. 190): — "Some days after the eruption of Krakatau in 1883 a female green monkey was found floating on some drifting timber in the Sunda Straits. She was terribly scorched, but completely recovered, and is, I believe, still alive". How long this green monkey (apparently the common macaque) remained "still alive" is not known but anyhow another female monkey may some day be drifted towards Krakatau in the same way and if it is a pregnant female we may be welcomed on landing on the island in the future by the chattering shrieks of macaques bounding in the trees along the beach.

Rattus rattus jalorensis BONH.

Mus jalorensis

BONHOTE, Fasc. Mal., Zoöl. I 1903, p. 28.

Rattus rattus neglectus

ROBINSON & KLOSS, J.F.M.S. Mus. VIII 2, 1918, p. 54 [1]).

Mus rattus rufescens

OTTEN, Med. B.G.D. 1924, p. 132, 164. VAN HEURN, Korte Med. Inst. Plantenz. 9, 1928.

Mus rattus jalorensis

DAMMERMAN, Treubia X 1928, p. 308. IDEM, Krakatau's New Fauna, 4th Pac. Sc. Congress, 1929 p. 90. IDEM, Agric. Zool. 1929, p. 280.

Rattus rattus roquei

SODY, N.T.N.I. 89, 1929, p. 163. IDEM, Z.M.L. 13, 1930 p. 94, 120. VAN HEURN, Z.M.L. 13, 1930, p. 151. KOPSTEIN, Med. D.V.G. I 1931, p. 42. IDEM, Z. Morph. Oekol. der Tiere 22, 1931, p. 792.

Rattus rattus alexandrinus rufescens

DE RAADT, Z.M.L. 14, 1931 p. 43, 187, 190; 16, 1933, p. 31.

Rattus rattus jalorensis

CHASEN, Bull. Raffles Mus. 8, 1933, p. 6.

Mus sp.; *Epimys* sp.

DAMMERMAN, Med. Lab. Plantenz. 24, 1916, p. 4. IDEM, Landb. Dierk. 1919, p. 222.

On Lang Island, the island of the Krakatau group which is not set apart as a nature-reserve, we found in 1928 abundantly a long-tailed rat with a pure white belly. The upper parts are glossy and of a dark grizzled tawny colour, the hairs interspersed with many slender flexible spines. The lower part of these spines is white but they become darker along the outsides towards the upper part, which is entirely blackish. Fur of the back otherwise composed of long black hairs each with a broad yellow-brown ring towards the end, the tip dark again; underfur of grey woolly hairs. The colour on the sides and the upper side of hind and forelimbs more greyish.

Young specimens are darker in colour and less spiny.

Under parts pure white, the white colour extending as far as the lower lips, the forepaws and feet, and in the male on the underside of the scrotum, the latter often with a rusty patch. In one example such a patch was found also on the breast. Line of demarcation between the colour of the upper and lower parts sharp. Fur consisting of white spinous hairs and white crinkled woolly hairs.

Feet above whitish, with a dark greyish brown median area.

Tail longer than head and body (107 - 131%, average 115%), entirely dark, clothed with dark stiff hairs which do not extend as far as the end of the scales of the following ring. Number of rings to the centimetre at the middle of the tail about 11.

Mammae 10: two pectoral and three inguinal pairs.

The penis-bone or baculum is a peculiarly shaped bone (see fig. 1), composed of two probably movable pieces, the posterior piece slender with a broadened base, the anterior part spatulate, flattened vertically. Total length 7,5 mm.

[1]) For the abbreviations see Treubia 13, 1931, p. 430.

For measurements see tables p. 432 & 434.

This rat was already extremely common on Lang Island when for the first time in 1928 the Vulcanological Survey made an observation-post on the island, so the species was not introduced by this party. Before that date the island had neither been inhabited nor even visited for any length of time. It cannot be supposed that any rats survived the catastrophe of 1883 by hiding in some underground burrow, as the whole island was covered by a thick layer of hot ashes and pumice-stone. This layer remained hot for several weeks so the rats could hardly escape destruction. Even if they did they would not be able to find any food for a long period, as the whole of the vegetation was destroyed and even the animal life in the sea in the neighbourhood of the islands was annihilated. It is practically certain, therefore, that the species arrived at the island either through a pregnant female being drifted to the shore on some floating log or other object, or it was introduced unintentionally by some fishing-boat.

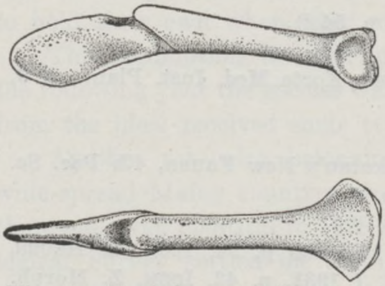

Fig. 1. Penis-bone of *R. rattus jalorensis*, side-view and dorsal view; 7 ×.

Every time we visited the island this rat was extremely abundant and at night an annoyance in the sheds built by the Geological Survey and the Marine Wireless Station. On one occasion, in February 1928, using only five traps, we caught no less than 49 specimens in one night. The rats do not appear to live in holes, we opened all kinds of holes but never found a rat, most of the holes being inhabited by large crabs which are formidable opponents and certainly able to keep the rats outside, even if unprotected by their burrows these crabs are a match for the rats. In daytime we never saw these rats in the low trees and shrubs covering the island, only once an old abandoned nest composed of dry leaves and small twigs was detected in a tree, which according to our native collectors was a rat's nest. On another occasion I saw a female carrying a naked young one in its mouth, running along the bamboo joints of our pondok, where it was probably nesting in the roof-thatching.

On Lang Island this rat is certainly not a true tree-rat, high trees being still absent on the island, it is far more accustomed to a terrestrial life, as at night many were always observed on the ground in search of food in and around our dwellings.

Lang Island II, 1928, 4 ♂♂, 2 ♀♀; XI 1932, 1 ♂, 2 ♀♀; I 1933, 1 ♂, 1 ♀.

We identified this rat with *Rattus rattus jalorensis*, BONH. "the Malay country-rat" [1]), originally described from the Malay Peninsula. For comparison we were able to examine good series of this form from the original locality, Sumatra and Java. We are indebted to the Director of the Raffles Museum at Singapore for the loan of the material of these rats from the said localities.

[1]) We prefer to call this rat "country-rat" to avoid confusion as the name "field-rat" (veldrat) is often used for the specialized form occurring in the rice-fields.

R. rattus jalorensis from the Malay Peninsula.

The specimens kindly lent by the Raffles Museum came chiefly from Perak and Kuala Lumpur, but there was practically no fresh material, most specimens having been caught between 1906 and 1910.

The colour of the upper parts therefore is a little faded and less glossy than in our series from Lang Island, but otherwise the colour and also the composition of the fur is the same. The colour of the underside is more creamy white and often soiled, this certainly also owing to the material being not so fresh.

The total length of these rats averages less than in the Lang Island specimens, but this is mainly due to the tail being shorter; head and body are on the average 168 mm, max. 175 mm, whereas the tail has a medium length of 180 mm and max. 193 mm (see table p. 431). Also the hindfoot (mean length 31,8 mm, max. 33 mm) seems to be a little shorter.

As to the skull there is a great similarity both in shape and in measurements between those of the Peninsular rat and of the Lang Island form (see table). The mean total length as well as the other measurements of the skull exactly match those of the Lang Island examples, the maximum length being 43.6 mm is only a trifle more than the maximum length of 43.2 mm measured in a specimen from Lang Island.

Regarding the habitat the labels of the Raffles Museum specimens tell us that some of these rats were trapped in the jungle, others near houses, and one was found in a hollow mangrove tree with the nest and three young, the nest composed of mangrove leaves and small sticks. Of the original series from which *jalorensis* was described 5 specimens came from deep jungle, the other 3 being caught in rice-fields.

If we compare the above data with those from the original description (by BONHOTE 1903) we find the following differences: the average measurements (in mm, those of the type in brackets) given for the head and body are 145 (144), tail 165 (177), hindfoot 30 (31.5); greatest length of skull 38.5 (40), basilar length 31.7 (32). All these measurements fall short of those resulting from the series at our disposal, but this may be the outcome of chance in collecting.

Recently CHASEN (1933) has published a more detailed description of the *jalorensis*-rats occurring in the Malay Peninsula. Their ranges come much nearer to those compiled above than those of the original description. We borrow for comparison the following figures from his paper, averages and maxima (in brackets): — head and body 165.6 (176), tail 173 (198), hindfoot 31.4 (35), ear 19.8 (22), percentage of tail to head and body 104.5 (115); skull occipito-nasal length 40.9 (44.3).

On the whole the Lang Island form agrees fairly well with the typical *jalorensis* from the mainland of the Malay Peninsula, the somewhat longer tail and larger feet do not justify subspecific distinction, there being too much variation in these characters. Moreover this primitive rat is liable to a great deal of variation as to its habitat and the length both of the tail and the

hindfeet seems to correspond to various modes of life. In some instances, however, as in the Java sawah-rat (the race of the irrigated rice-fields) these variable characters owing to adaptation to a very exclusive habitat during a prolonged period, become more stable and give rise to a very constant and different race.

R. rattus jalorensis from Sumatra.

We were able to examine only a small series of country-rats from Korinchi in Central Sumatra collected by the Raffles Museum in 1914 at an elevation between 700 and 1400 m. From other localities in Central or South Sumatra we have no material at hand which can be referred with certainty to *jalorensis*.

Above the Korinchi rats are snuff brown, a little darker and more glossy than the typical *jalorensis* but the colour is influenced by the spines which are less numerous, this being always the case with forms found in higher altitudes. The fur is similar but longer, more woolly and more dense, as could be expected of rats living in mountain regions. One example shows two rather large whitish patches, one on the left shoulder, the other behind the right shoulder.

Pelage of the under parts white but out of the series of 11 specimens 4 show a dark median grey line which is more conspicuous on the middle of the breast. In one example this greyish suffusion spreads over nearly the whole underside except on the throat and the innerside of the limbs. Probably this specimen is a transitional form approaching one of the semi-parasitic forms.

Feet above also somewhat darker.

As to the length of head and body, tail and hindfoot this mountain form comes very near the typical form from the mainland of the Malay Peninsula (see table p. 431).

The skull is on the average a little smaller, relatively shorter and broader, but this may be due to nearly half the number of specimens not being adult animals.

Although there are some differences between this mountain rat and the typical form these are certainly not of racial value. ROBINSON and KLOSS in their paper of 1918 called this rat *R. r. neglectus* [1]) and also stated after comparing the Korinchi series with a large number of *jalorensis* rats of the Malay Peninsula that no subspecific distinction is to be found amongst them.

Rattus rattus jalorensis from Java.

The Javanese country-rat (Mal. tikus ladang), formerly called *rufescens* (OTTEN, V. HEURN) is a well-known form, commonly referred to by the native name "tikus kuning" [2]) or "tikus pohon".

From Java we have before us a good series of this rat, material from West Java (Wijnkoopsbaai), Central Java (Karang Bolang) and East Java (Idjen) being kindly lent by the Raffles Museum.

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[1]) *R. r. neglectus*, however, is not a synonym of *jalorensis*, but of *diardi*, the house-rat.

[2]) The name "kuning" (yellow) was given on account of the yellowish underside of this rat.

The country-rats from West Java (loc. Wijnkoopsbaai and Buitenzorg) do not exhibit any essential differences from those from Lang Island, they present the same points of distinction from the typical *jalorensis* and those from Korinchi, having a larger hindfoot and a relatively longer tail.

The skull averages a trifle larger but otherwise in its proportions it is not different.

Of the Buitenzorg specimens one was trapped in a house and two caught in the Botanical Gardens. The weight of a full-grown animal is given as 122 grammes.

A good series of 12 specimens of this rat from Garoet, West Java, at an elevation of about 700 m, deserves special attention. We owe this series to the kindness of Mr. W. C. van Heurn who collected these rats between X and XII 1928 being at the time engaged with the economic side of the rat-problem.

The colour of the upper parts in these rats is perhaps somewhat lighter and the fur less spinous, the spines being less numerous and more slender. The underside is creamy white, sometimes washed with yellowish. This colour as well as the lighter hue of the upper pelage may be due to the specimens having been preserved in spirit. The tail is relatively longer, its percentage to head and body being on the average 123, ranging from 104 to 138 percent.

The body-weight is given as ranging from 115 - 147 grams, averaging 128 grams.

Four of the rats were caught in sugar-palms (Arenga), one in a coconut-palm, three came from salak-palms (Zalacca) and four again were found in Lantana-bushes.

Many of these rats are said to be parasitized by a cestode living subcutaneous, often also ascarides are found in the stomach and bladder-worms in the liver, different species of mites occurring as external parasites.

The series from Karang Bolang, Central Java (coll. Raffles Museum, II 1920) consists of 8 specimens. These agree fairly well with the other examples from W. Java and Lang Island averaging only slightly larger. Also the skull-length is on the average a trifle more. But these differences may be due to chance in collecting, especially if we have before us only small series and from a limited number of localities for comparison. Moreover, in maximum lengths they fall a little short of those from West Java.

The averages of a series of country-rats from East Java (all from the Idjen mountains between 500 and 950 m) are again a trifle less than those from Central or West Java, but otherwise they present no special points of distinction.

The Java country-rat has been made by Sody (1929) the type of a special form, *R. r. roquei.*

He separated this form from *jalorensis* on account of the larger skull, which according to him presents a maximum length of 45.5 mm as against 44.5 in *jalorensis* from the Malay Peninsula. Sody does not give the ranges of his series nor individual measurements except of his type-specimen, which having a skull-

length of 45.5 mm is obviously the largest example of his series. Furthermore his measurements are not quite exact as his figures are not in tenths of millimetres. Moreover, when comparing our figures we have to keep in mind that we measured the total skull-length (from the middle of the occipital crest to the anterior border of the premaxillae) whereas SODY gives the greatest length (including the nasalia).

From the measurements listed by us (table p. 436) we see, however, that the average skull-measurements of both forms agree exactly. We found the maximum total skull-length in examples from West Java to be 44.1 against 43.6 in *jalorensis* from the Malay Peninsula. But even if there does exist a difference in occipito-nasal length of 45.5 mm as against a maximum of 44,3 in Malay Peninsula examples (CHASEN 1933), the founding of a new subspecies on a difference of only 2 percent. in length in the largest examples is in my opinion an unwise procedure.

Further this author laid stress upon the greater length of head and body of his *roquei* compared with *jalorensis*. Our figures show that the Java specimens average somewhat larger than the Malay Peninsula form but it is mainly in the greater length of the tail and the hindfoot as already recorded also for the specimens from Lang Island.

VAN HEURN (1930) laid emphasis on the great differences in the life-history of the *roquei* of Java and *jalorensis* from the Malay Peninsula.

We will first refer to his interesting notes about *roquei*, which is called by him the Javanese tree-rat. According to him this rat lives chiefly in high trees, such as palms, but also in bushes, occasionally visiting houses or barns. In Java it is not a common rat and nowhere represented in large numbers. Its special habitat is lower and higher trees and it is seldom if ever found in holes. Nests are also made only in high palms or bamboo. Coconuts attacked by this rat show an irregular hole gnawed near the stalk of the fruit whereas the coconut-squirrel usually makes a round hole in the middle or near the top of the nut gnawing off first a considerable part of the husk. Its litter consists as a rule of 3 - 5 young. This rat in an able swimmer but it does not prefer inundated areas.

The author compares these results with the data communicated by WRAY in a paper on "the sugar-cane rat, *Mus jalorensis*" (Journ. F.M.S. Mus I, 1905, p. 39). This "sugar-cane rat" is extremely common in the Malay Peninsula and very destructive to rice-fields and other crops. It lives and nests in underground holes and the litters are much larger, sometimes as many as a dozen. If persued this rat escapes readily into the water. In all these respects this "sugar-cane rat" agrees exactly with the Java sawah-rat (*R. rattus brevicaudatus*).

Now in the first place our Java country-rat is not such an exclusively tree-loving animal as emphasized by VAN HEURN.

He bases his conclusions, I suppose, mainly on his observations made in

Garoet. But in other localities and especially on small islands untouched by human cultivation our rat readily descends to the ground and lives there in holes or in hollow trees and such recesses. Whether it is able to dig its own hole we have so far no proof.

Another point to notice is that there is a great deal of difference between the habitat afforded by the inundated rice-fields (sawah) of Java and the dry rice-fields such as are usually found in other less cultivated islands and also in the Malay Peninsula. VAN HEURN's statement that *jalorensis* was found by BONHOTE in "sawahs" is certainly erroneous. In his original description BONHOTE speaks of 3 specimens being caught in rice-fields (vide supra), but here without doubt are meant dry rice-fields, as his other examples came from deep jungle.

In the second place VAN HEURN says there can be no doubt that WRAY's notes refer to *jalorensis,* although this author himself speaks of the rat being "probably" *jalorensis.* From the recent paper by CHASEN (1933) we know now that the rice-field rat or sugar-cane rat of the Malay Peninsula is n o t *jalorensis.* This form is identified by him as *argentiventer* which comes very near to our Java sawah-rat or *brevicaudatus.* Whether these two forms are identical must be left undecided for the moment.

This examination of the facts reveals that when VAN HEURN contrasted the habits of the two rats from Java and the Malay Peninsula, he was referring to two different forms, so there is no need on these grounds to separate the Java *jalorensis* from the typical form.

It may be that the country-rat in Java is becoming more and more a semi-parasitic form owing to the vanishing of its original habitat in the low-lands and will be split in the long run entirely into a true digging and an arboreal form, the latter distinguished by the longer tail and somewhat brighter hue of the upper pelage.

If *jalorensis* can be a tree-rat as well as a burrowing rat we may look for characters by which these habits are to be discerned. DE RAADT (1913 & 1931) called attention to the differences in the pads or the hindfoot between the house-rat (*R. r. diardi*) and the rice-field rat (*R. r. brevicaudatus*). The first one being a climbing rat has these pads much more strongly developed than the digging rice-field rat.

Fig. 2. Sole of hind-foot of *R. rattus diardi*; 1⅓ nat. size.

The *rattus*-rats have 3 pairs of pads on the sole of the foot, two situated at the implantation of the three middle toes, one at the base of the large and another at the base of the little toe, and two behind these (see fig. 2). The four foremost pads are a little broader than the breadth of the toes, the two hindmost ones are a little narrower. On the forepaw there are 5 pads, one situated at the base of the two middle fingers, one pair behind this at the base of the exterior fingers, and two near the wrist, these two being much larger than the three others.

It is a fact that in the rice-field rat these pads are less developed and a little flatter and usually also smaller than in the house-rat. *Jalorensis* is usually somewhat intermediate between the two forms just mentioned. But there is much variation in development and by means of this character alone it is very difficult to make a correct identification. Moreover, this feature can only be made out in specimens still in the flesh or preserved in spirit, in dry skins it fails altogether.

Therefore we had to look for a more decisive character by which the burrowing and climbing habits could be distinguished and found such a character in the nails. The house-rat as a true climbing rat has curved, sharply pointed nails whereas the nails of the digging rice-field rat are stronger and larger, less sharpened and less curved being elongated and ending in a blunt point. In *jalorensis* we found the nails again somewhat intermediate: sometimes the nails are like those of *diardi,* other examples having them more like those of *brevicaudatus.* In the Lang Island specimens, however, the nails of the forpaw are very short and obtuse being nearly triangular in shape seen from the side (see fig. 3), but in a few examples they come nearer to those of the rice-field rat. Such very blunt and shortened nails obviously do not indicate a climbing habit but are built rather for digging and it may be that the very coarse material of which forms the soil on Lang Island, consisting mainly of a conglomeration of smaller and larger pumice-stones, has something to do with the rather peculiar shape of these nails.

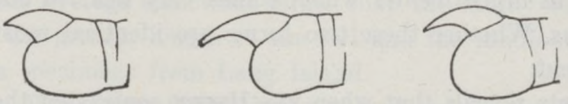

Fig. 3. Nails of the middle fingers of *R. rattus*; a. *R. r. jalorensis* from Lang I.; b. *R. r. brevicaudatus*; c. *R. r. diardi.*

In extreme development the characteristic form of the nail may be a certain indication for the mode of life of the rats, in other cases it may help in identifying a certain form better than the development of the pads on the sole which character is not practicable in skins.

Another question is whether we should apply subspecific names to the above mentioned forms of *rattus* which are certainly only ecological races. Many authors make no distinction between true geographical races and so-called minor forms. True geographical races as a rule should exclude and replace each other whereas ecological or habitat-forms may be found side by side in the same geographical area. Now most taxonomists agree that subspecific names should be applied only to true geographical forms and that ecological or habitat forms do not deserve a trinominal nomenclature. On the other hand we need to denote them, as botanists often do with their "Standort-modifikationen", in some way or another, and we could indicate them by applying e.g. the name *"forma arvalis"* for the digging form of the geographical race *jalorensis, "forma arborea"* for its long-tailed arboreal form, *"forma montana"* for the soft-furned less spinous or spineless mountain form. All these names would of course have

no priority but could be applied separately to each subspecies which showed this parallel development of environmental forms.

This is a more convenient mode of distinction than the application of a quadrinominal nomenclature, which is somewhat excessive, the first method having, moreover, the advantage of indicating that we are dealing with other races than geographical ones and at the same time giving by the name an indication of the habitat or habit of the form under consideration.

There is, however, one difficulty. In some cases we may be in doubt to which subspecies a certain minor form should be referred. For instance it is not quite clear whether our house-rat (*diardi*) is really a descendant of the country-rat *jalorensis*. We find rarely intermediate forms but it is possible that these are hybrids between the two forms. Moreover, house-rats are easily dispersed by man and in many localities in our Archipelago they are certainly immigrants and not derived from indigenous forms. The question can only be settled by breeding or observations on introduced rats (vide infra).

In such doubtful cases it will be better not to distinguish the habitat forms by a trinominal nomenclature but, by using the word "forma" after the specific name, to indicate that we are not dealing with a subspecific form but with an ecological race.

Measurements

jalorensis from Malay Peninsula

	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀
total length	354	357	362	357	350	343	339	332	344	337
head & body	175	172	169	166	170	170	167	165	164	159
tail	179	185	193	191	180	173	172	167	180	178
ear	20	20	21	21	—	22	22	20	—	20
hindfoot	32	32	33	32	31	33	33	30	32	30
tail-rings	11	13	11	9	11.5	12	10.5	11	11.5	11

jalorensis from Korinchi, C. Sumatra

	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀
total length	378	344	342	336	335	371	359	348	328	312
head & body	187	164	162	158	157	184	170	165	155	149
tail	191	180	180	178	178	187	189	183	173	163
ear	20	17.5	20	18	19	21	18	19	19	19
hindfoot	35	32	33	34	31.5	33 5	32	31	32	31
tail-rings	11	11	13	10.5	10.5	10	12.5	11	11	12.5

jalorensis from Lang Island (Krakatau)

Btzg. Mus. No.	3396	1556	1557	1555	3398	1554	1552	3394	1553	3397
	♂	♂	♂	♂	♂	♂	♀	♀	♀	♀
total length	403	401	386	383	366	330	388	375	358	330
head & body	187	185	187	179	172	143	184	176	170	149
tail	216	216	199	204	194	187	204	199	188	181
ear	21	20.5	20	20	—	18	20	20	21	20
hindfoot	37.5	35.5	35	35	34	34	35	34	35	34
tail-rings	10.5	11	11	11.5	11	11	9.5	10	11.5	11

jalorensis from W. Java

Btzg. Mus. No.				3401	958	3399	129
	♂	♀	♀	♂	♀	♀	♀
total length	405	363	349	387	402	359	—
head & body	185	170	169	174	191	171	156
tail	220	193	180	213	211	188	—
ear	22	21.5	20.5	19	21	21	15
hindfoot	36.5	33.5	34	36	35	32	32
tail-rings	11	10	10	11.5	9	11	11

jalorensis from Garoet, W. Java

Btzg. Mus. No.	2128	2121	2117	2120	2124	2112	2125	2129	2126	2122
	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀
total length	416	366	364	362	401	390	380	381	369	364
head & body	191	179	166	162	181	164	168	169	159	164
tail	225	187	198	200	220	226	212	212	210	200
ear	21	20	19.5	19	21.5	21.5	21	20	20	19.5
hindfoot	37	34	32	35	35	35	34	36	33	35
tail-rings	10	11.5	11	9	9.5	10	10	11	11	11

jalorensis from Karang Bolang, C. Java

	♂	♂	♂	♀	♀	♀	♀	♀
total length	403	392	376	405	395	386	390	375
head & body	187	182	176	188	183	176	176	172
tail	216	210	200	217	212	210	214	203
ear	20.5	20	20	21	22	21	21	21
hindfoot	35	37	34	35	35	35.5	36.5	34.5
tail-rings	11	10	10.5	10	11	10	9	11.5

jalorensis from Idjen Mts, E. Java

Btzg. Mus. No.				673	672	676	671
	♀	♀	♀	♂	♂	♀	♀
total length	355	353	346	366	358	389	394
head & body	165	158	151	169	175	185	190
tail	190	195	195	197	183	204	204
ear	19.5	20	20	20	20	20	21
hindfoot	33	33	33	33	31	35	34
tail-rings	10	11	11	10.5	10.5	9.5	9.5

Skull-measurements

jalorensis from Mal. Peninsula

	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀
total length	39.7	40	43.6	42	41.8	39.1	41.2	39	42	41.1
basilar length	36.2	—	39.2	38.1	38.1	36.1	36.3	36.2	38.1	36.8
zygomatic breadth	18.8	18.8	20.5	20 5	20.7	19.1	19.9	19	19.4	19.5
least interorb. breadth	6	6	7	7	7	6	6.4	6.5	6.6	6
cranial width	15 2	15.4	16	15.7	15.8	15.7	15.8	15.9	15.8	15.9
length of a nasal	13.9	14.3	16	15.8	15.5	14.7	15	14.6	14.6	15
greatest br. comb. nasals	3.8	4.5	4.4	4.7	4.5	4.3	4.6	4.3	4.1	3.9
incisive foramina	8	8	8.4	8.3	8.2	7.8	8 2	8 2	8.6	8.2
length of diastema	11.4	11.2	12.5	12.4	11.9	11.1	12.3	11	12.1	11.9
length upper molar ser.	6.8	7.3	7.5	7.2	7	7.1	6.8	6.7	7	6.5
length lower molar ser.	6.4	7	7.1	6.5	6.6	6.7	6.7	6.6	6.6	6.1

jalorensis from Korinchi, C. Sumatra

	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀
total length	40 8	38.3	39.6	38.1	38	40.2	40	38.4	39.4	37 9
basilar length	37.4	34.3	35.2	33.5	34.1	—	36.7	35.6	35.3	34 8
zygomatic breadth	19.3	17.3	19.3	—	18.3	20	19.8	18 8	19.3	18.7
least interorb. breadth	6	6.2	5.9	5.8	6.2	6.3	6.4	5.8	5.9	6 1
cranial width	15.5	13.7	15.8	15.7	15.6	15.6	15.7	15.2	15.4	15.5
length of a nasal	14 6	14 3	14.1	13 8	13.5	14.6	14.2	14.9	14.1	13.5
greatest br. comb. nasals	4 4	3.8	4	4.1	4.2	4	4.2	4 2	4 2	4.1
incisive foramina	8 1	7.7	7.9	7.4	7.1	7.6	8.1	7.5	8	7.2
length of diastema	11.7	11.1	11.4	10 6	10 8	11.6	11.5	11	11.1	10.6
length upper molar ser.	7	6.7	6.8	6 3	6.8	7	7.2	6.8	6.8	6.7
length lower molar ser.	7	6.3	6 5	6.1	6.4	6 5	6.9	6,4	6.3	6.4

jalorensis from Lang I. (Krakatau)

Btzg. Mus. No.	3396	1556	1557	1555	3398	1554	1552	3394	1553	3397
	♂	♂	♂	♂	♂	♂	♀	♀	♀	♀
total length	42.1	41	40.7	41.2	40 8	37.7	41.5	40.2	43.2	40.2
basilar length	38.8	37.3	37	37.7	37.3	33.9	38 5	36.2	39.3	36.7
zygomatic breadth	20	19.8	19 1	20.1	20.2	18.3	20.4	19.3	20	19.3
least interorb. breadth	6.7	6.5	6.3	6.4	6 6	—	6.2	6.2	6.9	6.2
cranial width	15.7	15	15.3	15.9	15.7	14.5	15 6	15.2	15.6	15.2
length of a nasal	15	14 8	14.8	14	15.3	13.7	15.6	14.3	16.2	13.7
greatest br. comb. nasals	4.3	4.2	4	4.7	4.4	4	4.4	4.2	4.6	3.6
incisive foramina	7.9	8.1	7,4	8	7.7	—	7.6	7.6	7.6	7.8
length of diastema	12.3	12.1	12	12.5	11.9	10.8	12.4	11.8	13.2	11.5
length upper molar ser.	7.2	7	6.8	6.7	7	6.8	7	6 5	7	6.7
length lower molar ser.	7.1	6 5	6.6	6.4	6.5	6 3	6.7	6.1	6.6	6.5

jalorensis from W. Java

Btzg. Mus. No.				3401	958	3399	129
	♂	♀	♀	♂	♀	♀	♀
total length	44.1	41.6	40.7	41.6	42.7	41.8	39.2
basilar length	40.5	37.6	37.5	38	39.6	38	36.8
zygomatic breadth	21.5	20 5	19.7	20.7	20.3	20.6	20.1
least interorb. breadth	7.2	6 6	6 4	6.3	6 8	6.3	6.2
cranial width	17.2	16.4	16.1	16.4	15.8	16.3	15.9
length of a nasal	17.3	16.5	15	15.6	16 2	14.6	14.4
greatest br. comb. nasals	4.9	4 7	4.4	4.5	4.8	4.5	4
incisive foramina	8	7.4	7.5	7.1	8.1	7.6	7.4
length of diastema	12.3	11.4	11.2	11.3	12.5	11.8	10.7
length upper molar ser.	7.8	7.1	7.8	7.7	6.9	7.2	7.8
length lower molar ser.	7.2	6.8	7.3	7.5	6 6	6.6	7.4

jalorensis from Garoet (W. Java)

Btzg. Mus. No.	2128	2121	2117	2120	2124	2112	2125	2129	2126	2122
	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀
total length	41 3	40.1	38 6	40 8	42.3	41.6	40.7	40.4	38 4	38.5
basilar length	38.4	37	35 9	36.6	38.9	37.5	37.7	36 6	35 9	35
zygomatic breadth	19.7	20.4	19	20	21.5	20	21.2	20 4	19.2	19.4
least interorb. breadth	6.7	6.2	6.7	6 1	6.5	6.6	6 3	6	6.1	5.8
cranial width	16.3	15.9	15.4	15.7	16 3	15.8	15.5	15 8	15.2	15.6
length of a nasal	15.3	15.3	14.4	14.6	15 6	15 2	15.2	14 5	14.4	14
greatest br. comb. nasals	4.6	4.5	4.3	4	4.4	4.4	4.4	4.1	4.3	4.1
incisive foramina	7.8	7.6	7.2	7.4	8	7.4	7.9	7.6	7.8	6.6
length of diastema	11.8	11	11	11	12 3	11.4	11.4	11.2	11.1	10.3
length upper molar ser.	7.5	7.2	7	7.5	7.1	7 6	7.1	7.2	6.7	7.2
length lower molar ser.	6.9	6.9	6.9	7.3	7	7.5	7	7.2	6.5	7

jalorensis from Karang Bolang, C. Java

	♂	♂	♂	♀	♀	♀	♀	♀
total length	42.1	43.8	40.3	43.4	41.7	43	43.2	41.3
basilar length	38.4	40	37.5	40	38.7	38.6	40.6	38.4
zygomatic breadth	19.7	21.7	19.2	21.1	20.3	20.4	20.4	19.7
least interorb. breadth	6.7	6.6	6.3	6.5	6.9	7	6.8	6.2
cranial width	15.7	17.3	16.1	16.4	16.3	16.1	16.6	16.1
length of a nasal	15	16.4	15.1	16	15.5	15.8	15.7	14.9
greatest br. comb. nasals	4.8	4.8	4.2	4.5	4.8	5	4.8	4.3
incisive foramina	7.6	7.3	7.9	7.8	7.5	7.9	8	7.6
length of diastema	11	11.5	11.1	12.6	11.5	12	12.1	11.6
length upper molar ser.	7.3	7.6	7.1	7	7.4	7	7.2	6.6
length lower molar ser.	—	7	—	6.7	7.2	6.7	7	—

jalorensis from Idjen Mts, E. Java

Btzg. Mus. No.				673	672	676	671
	♀	♀	♀	♂	♂	♀	♀
total length	39	41.7	39.2	38.6	40.8	43.9	43.7
basilar length	35.3	38	34.4	35.4	38.3	40.5	40.2
zygomatic breadth	18.7	20.5	18.8	19	20.5	21.3	21.9
least interorb. breadth	5.9	6.6	6.3	6.2	6.6	7.2	7.2
cranial width	15.6	16.1	16	16.1	15.8	16.8	16.8
length of a nasal	13.4	15.2	13.9	13.2	13.9	16.3	16.1
greatest br. comb. nasals	4.3	4.4	4.2	4	3.9	4.8	4.6
incisive foramina	7.3	8	7	7	7.7	7.9	8.5
length of diastema	10.1	11.5	10	10	11.7	11.8	12
length upper molar ser.	7.8	7.4	7.3	7.3	6.8	7.7	7.7
length lower molar ser.	7.3	7	7.5	6.9	6.7	7.5	7

Average measurements of *R. r. jalorensis*

	Mal. Pen.	Korinchi	Lang I.	W. Java	Garoet	C. Java	E. Java
total length	347	345	372	378	379	390	366
head & body	168	165	173	174	170	180	170
tail	180	180	199	201	209	210	195
percent. tail to h. & b.	107	109	115	115	123	117	115
ear	20.8	19.1	20	20	20.3	20.8	20
hindfoot	31.8	32.5	34.9	34.1	34.6	35.3	33.1
tail-rings	11.1	11.3	10.8	10.5	10.4	10.4	10.3

Average skull-measurements of *R.r. jalorensis*

total length	41	39.1	40.9	41.7	40.3	42.3	41
basilar length	37.2	35.2	37.3	38.3	37	39	37.5
zygomatic breadth	19.6	19	19.7	20.5	20.1	20.3	20.1
least interorb. breadth	6.5	6.1	6.4	6.5	6.3	6.6	6.6
cranial width	15.7	15.4	15.4	16.3	15.8	16.3	16.2
length of a nasal	14.9	14.2	14.7	15.7	14.9	15.5	14.6
greatest br. comb. nasals	4.3	4.1	4.2	4.5	4.3	4.7	4.3
incisive foramina	8.2	7.7	7.7	7.6	7.5	7.7	7.6
length of diastema	11.8	11.1	12	11.6	11.3	11.7	11
length upper molar ser.	7	6.8	6.9	7.5	7.2	7.2	7.4
length lower molar ser.	6.6	6.5	6.5	7.1	7	6.9	7.1

Max. measurements of *R.r. jalorensis*

head & body	175	187	187	191	191	188	190
tail	193	191	216	220	226	217	204
hindfoot	33	35	37.5	36.5	37	37	35
total length of skull	43.6	40.8	43.2	44.1	42.3	43.8	43.9
length upper molar ser.	7.5	7.2	7.2	7.8	7.6	7.8	7.8

Rattus rattus diardi JENT.

DAMMERMAN, Treubia 3, 1922, p. 65. IDEM, Krakatau's New Fauna, 4th Pac. Science Congress, 1929, p. 93.

On the main island of the Krakatau group, Krakatau itself or Rakata, occurs the house-rat which was found there for the first time in 1919 on the south-eastern side of the island. In subsequent years material was collected at the same spot, but only once, in 1920, an example was trapped on the opposite side of the island, near "Zwarte Hoek". The colour of the lower parts of this specimen is dark mouse-gray, much darker than in examples from the S.E. corner. Otherwise the colour of upper and under surface of these rats is not different from ordinary house-rats and varies in the same way especially as to the ventral surface. These parts are light greyish to deep mouse-gray in colour, a few specimens with a tawny suffusion or a more or less distinct brownish median line. In the lightest example the gorget is white, there is a broad median stripe on the throat and the innerside of the forelimbs and the axils are whitish.

From the figures given in the table below, we may see also that the average measurements and their ranges do not show any essential differences from those of other house-rats. Only the number of tail-rings being on the average 12.5 seems a trifle higher than is usually the case.

On the feet the pads are strongly developed, the nails being formed as in house-rats generally but a few specimens have the nails more prolonged as in *brevicaudatus*.

In all females the number of mammae is 2 - 3 = 10.

The penis-bone has the same form as in *jalorensis*.

Measurements

R. r. diardi from Krakatau

Btzg. Mus. No.	2099	2100	3405	3406	3407	3408	3409	3410	3411	3412	aver.
	♀	♀	♀	♀	♀	♀	♂	♂	♂	♀	
total length	360	355	380	355	370	387	383	—	382	346	366
head & body	184	170	186	167	182	188	196	183	187	173	182
tail	176	185	194	168	188	199	187	—	195	173	185
ear	—	—	19	19	19.5	20	21	19.5	20	19	19 6
hindfoot	34	34	35	32	32	34	34.5	32	33 5	32.5	33.4
tail-rings	12	15	11	12	13	12 5	12	13	12	12.5	12.5

Skull-measurements

total length	43.1	40.8	42.7	40	41.5	42.8	44.6	41.5	42.7	40.7	42
basilar length	38.6	37	38.6	36.5	37.2	39.1	39.8	37.2	39.8	36.7	38
zygomatic breadth	20.4	18.6	20.3	18.5	19.1	20.2	20.6	19.3	19.4	19.7	19.6
least interorb. breadth .	6.7	5.8	6.4	5.8	6	6.2	6.2	6.1	6	6	6.1
cranial width	16.4	15.7	16.5	15.3	15.4	15.9	16.4	16.1	16.2	15.8	16
length of a nasal	14.8	14.4	14.4	13.5	14.2	14.4	15.4	14.5	14.7	14.1	14.4
greatest br. comb. nasals	4.3	4	4.4	4	4.1	4.3	4 5	4	4 1	4	4.2
incisive foramina	8.7	8.1	8.6	8	8.2	8 4	8.5	8	8.8	8.1	8.3
length of diastema	12	11.3	11.5	10.7	11.6	12.2	12	11.1	11 5	11	11.5
length upper molar ser.	7.2	6.7	7.3	6.8	6.8	7.3	7.2	7.2	7.5	6.6	7.1
length lower molar ser.	6.4	6	6.6	6	6.2	6.4	6.6	6.5	6.6	6.5	6.4

House-rats are now fairly common on Krakatau Island and were certainly introduced by man. When a certain Mr. HANDL settled on the island at the S.E. corner in 1917 there were, according to him, no rats but soon afterwards he observed them in sufficient numbers to be a great nuisance.

In my paper of 1922 I supposed that the rat found at the N.W. corner of the island (near Zwarte Hoek) came from the other side of the island as it did not seem probable that house-rats would have been imported into Kra-

katau twice at two different places. But after that single capture of September 1920 we were never again able to trap a specimen at the said spot and as the only example caught there has a much darker ventral surface than any rat from the S.E. side of the island we may not exclude the possibility of a second import at Zwarte Hoek.

Every time we visited the island previous to July 1924 we were able to trap some specimens. On that occasion we did not succeed in getting any although we set large a number of traps, as usual, nor were they observed at our camp either in the daytime or at night. In a previous paper (Treubia 8, p. 291) I presumed this species of rat had already disappeared from Krakatau in the few years since Mr. HANDL left the island (1921) house-rats being apparently unable to maintain themselves if they are compelled to live independent of men. But as later on they were found again in numbers and as at the same time in 1924 we found a few full-grown pythons and a number of young ones, probably the increase at that time of these large rat-feeding snakes must be regarded as responsible for the temporary disappearance of the rats. In January 1933 they occurred again in fairly large numbers at the same spot, the pythons being then absent.

It is interesting to ascertain how these house-rats lived after Mr. HANDL's departure in 1921, when his house, built of wood and bamboo, fell into disrepair and after a few years was razed to the ground.

After that year the rats had to return to a wild life, to nest in natural abodes and to find their own food. We were able to examine a number of stomach contents and found them to consist mainly of vegetable matter, in few instances the presence of starch could be proved, probably from seeds, and in two examples the remains of insects were to be observed, but only in small quantity.

If the Malay house-rat is a derivative of some indigenous wild rat (f.i. *jalorensis*) it would be important to observe what changes will occur after a sufficient lapse of time when these rats cease to be semi-parasitic on man and are compelled to live a wild life. In the first place we may presume that the rats living a more out-door life will become lighter in colour, especially the under parts. There is, however, up till now, not the slightest indication of the lower parts becoming less dark. The specimens caught in 1934 are as dark as or even darker than examples found in 1920. But it is probable that the house-rat acquired the characteristics that distinguish it from the more primitive country-rat already in very remote times, so the reversion to the original type may take a great number of generations during a long period. It is to be hoped that the house-rat on Krakatau will remain isolated and no other allied form or species will be introduced so that it will prove possible to pursue this question further.

As to habits we may suppose that these house-rats change to a more terrestrial life, but although the nails of a few specimens seem to indicate that they become more inclined to burrowing, the still strongly developed pads on

the feet are evidence that the climbing habit is certainly not being abandoned. At night we often saw these rats on the soil or running along the branches of the low trees fringing the beach, apparently searching for food. Once at twilight we observed a rat coming out from the wood and skipping towards the sea but as soon as it encountered the surf-rollers spreading on the sand it quickly ran back to the shelter of the forest. We could not detect nests of the rats in the trees but once we found a female with a litter of young ones under a log, this was at the time Mr. HANDL still lived on the island. After the ruination of his house a rat was detected in a hole at the base of an old tree.

Krakatau N.W. IX 1920, 1 ♀; Krakatau S.E. XII 1919, 1 ♀; IX 1920, 1 ♀, 1 juv.; V 1929, 3 ♀♀; I 1933, 1 ♂, 4 ♀♀; IV 1933, 2 ♂♂, 2 ♀♀; IV 1934, 1 ♂, 1 ♀.

House-rats are also found in and near the native houses on Sebesy, the island in the neighbourhood of the Krakatau group.

Rousettus amplexicaudatus E. GEOFFR.

This species was detected only lately (1933) in a cave on Lang Island.

The very short and adpressed fur of the back is of an umber or sepia colour; head above darker; neck and rump much lighter, isabel colour. Underparts tawny, middle of breast and belly and sometimes the whole under surface, more greyish drab; chin and throat lighter, sparsely haired.

Measurements

Btzg. Mus. No.	3377	3378	3379	3380
	♂	♂	♀	♀
total length	128	130	129	126
head & body	108	110	110	107
tail	20	20	19	19
ear	18	19	17	17
forearm	80	78	79	79
expanse of wings	482	474	470	468

Skull-measurements

total length	36.5	36.3	34.8	34 8
zygomatic breadth	22.2	22.7	20	20 2
rostrum, orbit to nasals	12.3	12	11.9	11.3
least interorb. breadth	8	8	7.1	7 3
cranial width	13.5	14 5	13.3	13 6
width across m^2, extern	10 3	10.6	9.3	9.9
upper teeth-row	13.2	12.8	12.3	12 6
lower teeth-row	14.6	14.7	13 6	14.1

In *R. a. minor* from Java the forearm is much shorter, also the skull-measurements average smaller than in the typical *amplexicaudatus* from Sumatra, although our series consists of individuals coming in this respect nearer to *minor* as is to be expected in forms living in the transitional region between the true ranges inhabited by the two subspecies.

This bat was found to be fairly abundant in a cave in rocky cliffs at the east coast of Lang Island, which could be reached only by boat.

Lang Island, XII 1933, 2 ♂♂, 2 ♀♀.

Cynopterus brachyotis angulatus MILL.

DAMMERMAN, Treubia III 1922, p. 65. IDEM, Krakatau's New Fauna, 4th. Pac. Science Congr. 1929, p. 97.

This species was first found by SUNIER in 1919 both on Krakatau and Verlaten Island. Later on Dr. DOCTERS VAN LEEUWEN collected six more specimens on Krakatau S.E.

In the male the colour of the back is buffy brown-olive, sometimes more rusty; head somewhat darker; sides of neck and breast clay color; underparts buffy brown. Ears narrowly edged by white. Metacarpals and phalanges conspicuously whitish.

The female is darker above, more olive-brown throughout there being hardly any contrast between the colour of the neck and sides of the breast.

Young specimens are more like the female.

Total length of No. 1542 ♂; 116 mm, tail 10 mm.

" " " " 1543 ♀; 122 mm, " 10 mm.

Length of ear (all measurements taken from specimens preserved in spirit) 15.5, 16.5, 17, 17, 17.5 and 18 mm.

Forearm: 63.5, 67, 68.5, 69, 69, 69, 71 and 72 mm.

Of the eight specimens three are young.

Skull-measurements

Btzg. Mus. No.	15	1542	16	1543
	♂	♂	♀	♀
total length	32.7	33.2	—	30.3
zygomatic breadth	21	20.3	18.2	20
rostrum, orbit to nasals	8.1	8.3	7.9	7.7
least interorb. breadth	6 5	6.3	6.2	6.1
cranial width	13.7	13.4	12.9	12.9
width across m^1, extern.	9.9	8.9	8.8	9
upper teeth-row	11.2	10.4	10.3	10
lower teeth-row	12.4	11.7	11.2	—

The shape of the teeth and the absence of a cusp in p_4 and m_1 indicates that our species is a member of *Cynopterus* section proper. But than we have to decide whether it belongs to *C. sphinx* (*marginatus*) or *C. brachyotis*. These two species are very similar and can only be distinguished by the length of the ears which is 18 - 20 mm in *C. sphinx* and 13 - 18 mm in *brachyotis*. Now unfortunately none of the measurements given above were taken in the flesh, but even allowing a certain percentage of shrinkage for the preservation in spirit the length of the ear is certainly not more than 18 mm, the minimum length in *C. sphinx*. Moreover the forearm is 74 - 83 mm in *C. s. tithaechilus* (from Sumatra and Java), the only subspecies of *C. sphinx* which need be considered here, and the maximum in our series is 72 mm. Also *tithaechilus* has a much larger skull, 35.5 - 38.5 mm.

So from these data and from the white metacarpals and phalanges contrasting strongly with the dark membrane we refer our specimens to *C. brachyotis*.

We first thought the form had to be referred to *C. sphinx* as we had before 1928 only one adult (from Verlaten Isl.) and one example from the nearby Sebesi Island (X, 1921), of which we had measurements taken in the flesh. The latter specimen, however, having a forearm of 76.5 mm and an ear-length of 20 mm certainly belongs to *C. sphinx tithaechilus*.

If the Krakatau species is *C. brachyotis* the question arises to which subspecies it has to be allocated. From the larger forearm and greater length of skull and rostrum, characters which exclude it from *C. b. brachyotis* from Sumatra and *C. b. javanicus* from Java, we think our form must be *C. b. angulatus*, a subspecies having a very wide range occurring from Assam to Sumatra.

Krakatau S.E., IV 1919, 1 ♀ juv. (leg. A. Sunier); V 1928, 3 ♂♂, 3 ♀♀ (leg. W. Docters van Leeuwen); Verlaten I., IV 1919, 1 ♂ (leg. A. Sunier).

Cynopterus horsfieldi minor Lyon.

Dammerman, Treubia III 1922, p. 65; Idem, Krakatau's New Fauna, 4th Pac. Science Congr. 1929, p. 97.

A second species of *Cynopterus* is found on the main island of Krakatau and was lately (1930) also collected on Verlaten Island.

In the male the upper parts are buffy to olive-brown, the head somewhat darker, colour of the sides of the neck and shoulders ferruginous or cinnamon-rufous. Underfur on the back composed of light greyish woolly hairs. Middle area of the ventral surface olive-drab but the sides and other parts rufous, this colour also extending on the underside of the upper arm. Innerside of lower arm and legs sparsely covered with yellowish hairs.

Female much lighter in colour, on the back deep olive, underside greyish olive, sides of the neck, foreneck and shoulders old gold or isabel colour.

Ears dark narrowly margined with white.

Wings also dark with conspicuously whitish metacarpals and phalanges.

Total length of the full-grown male 105 mm, of the semi-adult female 96 mm, forearm in both sexes 71 mm; expanse of wing of the male 487 mm.

Skull-measurements

Btzg. Mus. No.	7 [1]	707	32	2455
	♂	♂	♂	♀
total length	—	33.7	31.5	31.2
zygomatic breadth	—	22.6	21.7	21.1
rustrum, orbit to nasals	6.6	8	6.8	7.3
least interorb. breadth	5.5	6.2	5.5	5.6
cranial width	—	13.6	13.2	12.9
width across m^1, extern.	9.5	9.6	9.4	9.4
upper teeth-row	10.8	10.6	10.3	10.2
lower teeth-row	12.5	12.1	12	11.8

[1]) Skull of No 7 badly smashed.

The species is distinguished from the foregoing one by the larger, more rectangular teeth, the broader palate and the cusps on the third and fourth lower molars (p_4 and m_1).

The series of four specimens contains only one full-grown male (No. 707), the others being semi-adults. This male with a skull-length of 33.7 and a forearm of 73 mm comes within the range of the subspecies *minor*, but otherwise the measurements are not so convincing. *Minor* is recorded from Sumatra whereas the typical *horsfieldi* comes from Java. Probably specimens found in South Sumatra and on islands in the Sunda Straits are intermediate between the subspecies which are very similar, differing only in size.

One specimen was caught in Mr. HANDL's house (1920), the others were found roosting during the day in shrubs.

Krakatau S.E., IV 1920, 1 ♂; IX 1920, 1 ♂ (leg. H. C. SIEBERS); VII 1924, 1 ♂; Verlaten I., VIII 1930, 1 ♀.

Hipposideros diadema E. GEOFFR.

DAMMERMAN, Krakatau's New Fauna, 4th. Pac. Science Congr. 1929, p. 97.

The only example of this insectivorous bat was collected by Dr. DOCTERS VAN LEEUWEN on Krakatau East at an altitude of 600 m.

The forearm is 85 mm. From this and from the skull-measurements (see below) our specimen could as well belong to the subspecies *vicarius* AND., known from Sumatra, Borneo and Celebes, as to the typical *diadema*, recorded from Java. These two subspecies are very closely related and hardly separable.

Skull-measurements (No. 1541)

total length	31.6	mm
zygomatic breadth	18	„
least interorb. breadth	3.6	„
cranial width	11.5	„
anteorbital width	9	„
maxillar width	12.3	„
upper teeth-row	12.6	„
lower teeth-row	13.9	„

Although we are dealing here with a full-grown adult it is certainly not a very old individual as the teeth are very little worn, therefore the specimen is difficult to allocate. Only the smaller size and the small anteorbital width, having a minimum of 9.5 mm in the typical *diadema,* brings our example nearer to *vicarius.* On the other hand the lateral vertical ridges on the front face of the posterior nose-leaf are said to be less conspicuous in *vicarius,* but I cannot find any difference in this respect in Java specimens. Also a small fourth supplementary leaflet on the side of the horseshoe is found both in Java forms and the specimen from Krakatau.

Whether the very slight differences between the two above-mentioned subspecies are really constant enough for justifying their validity must remain undecided until larger series are examined.

Krakatau E., 600 m alt., V 1928, 1 ♀ (leg. W. DOCTERS VAN LEEUWEN); (specimen preserved in spirit, skull extracted).

Skull-measurements (No. 1541)

total length	21.6	mm
zygomatic breadth	13	„
least interorb. breadth	3.6	„
cranial width	11.5	„
anteorbital width	9	„
maxillar width	12.3	„
upper teeth-row	12.6	„
lower teeth-row	13.9	„

Although we are dealing here with a full-grown adult it is certainly not a very old individual as the teeth are very little worn, therefore the specimen is difficult to allocate. Only the smaller size and the small anteorbital width, having a minimum of 9.5 mm in the typical diadema, brings our example nearer to vicaria. On the other hand the lateral vertical ridges on the front face of the posterior nose-leaf are said to be less conspicuous in vicarius, but I cannot find any difference in this respect in Java specimens. Also a small fourth supplementary leaflet on the side of the horseshoe is found both in Java forms and the specimen from Krakatau.

Whether the very slight differences between the two above-mentioned subspecies are really constant enough for justifying their validity must remain undecided until larger series are examined.

Krakatau I., 600 m alt., V 1928, 1 ♀ (leg. W. Docters van Leeuwen) (specimen preserved in spirit, skull extracted).

THE INFLUENCE OF THE QUALITY OF THE FOOD ON THE EGG-PRODUCTION IN SOME INSECTS.

By

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INTRODUCTION.

In studying the gradation of insect populations, the economic entomologist has to face three problems, viz. the status of parasites, the climatic environments and the food conditions.

Although nearly every author on gradation in insect pests is fully aware of the fact, that the food must play an important role, it is nevertheless curious to see, how little work, compared with that carried out on the effect of temperature or of parasites, has been done in this line of research.

Now the investigation of the influence of food conditions upon the gradation in nature is not so easy. Not only is it necessary to take into account the quantity and the quality of the food-supply, but we must know further which part of this food can be utilized by the insects. If we take three insects, a bug, a beetle and a caterpillar feeding on the same leaf, the chemical analysis of this leaf will say us next to nothing of its influences on the rate of reproduction. Generally speaking the bug will only use the contents of the phloem, the beetle grinds up the whole leaf, but much of the contents of the different cells will pass the intestine not or only slightly digested, and again in caterpillars only those cells are used, that have been cut into two by the mouth-parts.

But here the chain of the different possibilities does not end. If we rear a plantbug and an aphid on the same leaf, we may assume, that the food they suck in both cases is the same. Nevertheless the result may be quite different. The aphid will thrive, when the food is high in carbohydrates, the bug shows its greatest fertility when the food is rich in albuminoids, thus showing that

the same quality of the food may have a different effect on different species.

The quantity of the food although of prime interest in such animals as *Cimex,* plays in most cases only a role as soon as food is growing short, that is to say, when the damage has been done. The aim of the economic entomologist is to prevent such a calamity and what occurs afterwards is, as a rule, of small interest to him. In some cases however it may be necessary to know, which are the effects of shortage of food on the gradation in the following generations.

In tropical countries as a rule, we need not consider the quantity of the food. In many cases food is plentiful throughout the year; in other cases only during very definite periods in which the crop is grown or the seed ripens, but really devasted areas, where 100 % of the food available has been used by the insects, although they do occur, are very rare.

Field observation revealed the fact, that even adjacent plots might differ considerably in their liability to insect attack. The planter used to ascribe this to differences in the health of the plants. If we translate health by composition of the insect food, we may say that he is right.

The question then arises, which peculiarity in the composition of the insect food makes, that one plot is heavily infested, whereas another close by may be not or only slightly infected.

We know that the manuring will change the chemical composition of the leaf, thus another still more important question occurs to us; are we able to change the conditions for the food-plants to such an extent, that the liability to insect attacks diminishes. In other words, is it possible to combate insect pests by cultural measurements.

The literature on this subject, mainly dealing with the influence of manuring and tillage on the intensity of insect (and fungous) attack has quite recently been reviewed by BRAUN (1937), so that it is not necessary to discuss the different papers here. Some of them will be mentioned in connection with the experiments described hereafter.

The chief aim of this work was to ascertain if the influences of the quality of the food on the egg-production of insects, with the exclusion of the differences which are inherent to the use of different food-plants, could be large enough to be of interest to the economic entomologist. It is naturally divided in two parts, the first one deals with the behaviour of the insects on unmanured plants, the second with the effect which manuring of the plants ultimately has on the egg-production of the insects. The second aim was, if possible, to investigate the nature of these influences.

In this paper the behaviour of the insects on the unmanured plants are described.

The work was carried out at the Treub-Laboratory of the Botanical Gardens at Buitenzorg. Grateful acknowledgements must be paid to the Director

of these Gardens, Dr. K. W. DAMMERMAN, for putting a working table at the disposition of the author. Investigations with *Helopeltis* took place at the Tea Experimental Station Buitenzorg during the years 1932-34. Part of the results were published in the Archief voor de Theecultuur.

METHODS and MATERIALS.

When studying the influence of the variations in the quality of the food on insects, one should take care of an adequate control of all other conditions. That is to say, climatic and environmental conditions should be eliminated as factors affecting the egg-production or other phenomena that are likely to be studied.

Thus stress should be laid on the absolute necessity of allowing the food to vary only, the other conditions must remain as much the same as possible. Unfortunately it was not possible to carry out the different experiments under exactly the same conditions. Temperature could not be kept constant, indeed it fluctuated from 25 to 30 degrees Celcius in the course of the day. Light conditions were apt to vary considerably. Only the relative humidity was kept constant at about 100 %.

For these reasons experiments taken at different times of the year could not be combined. Only a comparison between those run during the same period was allowed.

As a rule the insects were kept in glass vessels which were placed before a north window of the laboratory in such a way, that the direct sunlight could not enter them (in the months of May-August). The leaves which served as food were changed every morning between 8 and 10. A thoroughly wettened piece of cotton-wool was put on the base of each leaf to prevent it from loosing its turgor. In the case of *Helopeltis* small bottles were used, wherein the tea-shoots were placed. The vessels were closed, so that the living leaf combined with the wet piece of cotton-wool soon made the relative humidity rise to saturation.

In this way conditions other than food were the same for every individual insect included in the experiment. For every individual the temperature would vary in the same way and to the same degree. Table 1 *) shows the temperature during the months of September and November 1936.

Light conditions would only differ slightly. The relative humidity was always about 100 %.

This high humidity as a matter of fact is a distinct drawback in rearing insects. An absolute 100 % saturation, if it could be maintained long enough, might even proof fatal to a great number of insects. Specially troublesome was the high humidity when rearing larvae of *Helopeltis*. Working with caterpillars, the wet cotton-wool had to be left out in the fourth and fifth stages. The insects

*) For table 1, 4 - 9, see the end of this paper.

being then very susceptible to an excess of moisture. In one case larvae of *Euchromia horsfieldi* MR. were fed with leaves of *Ipomoea arborescens* DON. which were wettened by the rain that had fallen over night. Of the about 200 larvae only three gave moths.

Nevertheless it was thought necessary to keep the relative humidity high, because otherwise it would escape all observation. The evident disadvantages in rearing had to be taken into the bargain.

The leaves were always offered abundantly, so that the larvae or the imagines had not to shift for themselves in obtaining their food and could eat as much as they liked.

Another factor which is very important, is the effect of crowding upon the fertility of the insects. It was therefore absolutely necessary to use the same number of insects in glass vessels of the same form and of the same solid content.

Thus the only difference between the various vessels in one experiment was the quality of the food they contained.

The insects used in the experiments were *Helopeltis theivora* WATERH.; *Epilachna* sp. feeding on *Datura fastuosa* L.; *Tinolius eburneigutta* WLK.; and *Diacrisia strigatula* WLK.

To make things as simple as possible only one kind of food-plant was used in every experiment. In the case of *Helopeltis, Thea assamica* MAST. was used. *Epilachna* was fed with the leaves of *Datura fastuosa* L., *Tinolius* and *Diacrisia* got leaves of *Thunbergia grandiflora* ROXB.

The differences in quality were obtained by taking leaves of different age, by selecting different plants of the same species and by technical methods.

The first kind of food was the fresh full-grown leaf taken from the plant every day about 7.30 a.m.

Only one third of the leaves plucked were given as food to the insects under observation immediately. In the experiments it is indicated as leaf I.

One third was kept with the stalks in a glass jar with water over night and given to another collection of insects the following day. This is leaf II. The rest was kept for two days and given to still another collection of insects as leaf III.

The leaves that were kept aside to serve as food for the insects at the end of 24 or 48 hours after picking were placed on a table at a distance of at least two meters from the window. Here CO_2 assimilation was practical nil, and as respiration continued uninterruptedly, a constant decrease of the carbo-hydrates took place.

In this way we obtained three kinds of food differing chiefly from one another by the quantity of the carbo-hydrates. This being the highest in leaf I, the lowest in leaf III. Other chemical changes which might have taken place were not taken into account.

Apart from the full-grown leaves, half grown and very young leaves were

used. They were always given in a fresh state. In the experiments they are indicated as leaf M and J.

In the case of *Helopeltis* only young tea shoots of a maximal length of about 15 cm could be used as food, so that the differences between old and young could not come into consideration. Here an other quality of the food was made, by cutting away in a full circle the bark of a branch at its base. This prevents the carbo-hydrates formed in the leaves to travel down to the roots. After some time the wood of the branch is full of starch. This has a very definite influence upon the young shoots growing above, as the formation of young leaves almost comes to an end apparently as soon as the quantity of carbo-hydrates reaches a definite level. Leaves from these branches are quite full of starch. In the experiments they are indicated as leaf A.

Experiments with *Epilachna*.

Imagines of *Epilachna* were captured in the Botanical Gardens on *Datura fastuosa* L. and made to oviposit on leaves of this plant in the laboratory. There was hardly any mortality in the egg-stage, the only trouble sometimes was the voracity of the newly hatched larvae. Even if fresh food was available, they showed more or less cannibalistic tendencies and ate the neighbouring eggs, which had not yet hatched. The high relative humidity may have favoured these tendencies.

190 of these larvae were placed in glass-vessels of 400 cc solid content, containing 9 or 10 larvae each. 95 of them were fed with fresh leaves of *Datura fastuosa* (leaf I), the others with leaves which had been kept for one day in the laboratory (leaf II). The first imago appeared 19 days, the last one 26 days after the larvae had hatched. The duration of the pupal stage was 4 days, thus the larval developmental period ranged from 15 to 22 days. The temperature during this period is shown in table 1.

Owing to the less favourable environmental conditions (the excessive humidity will have played an important role), the mortality during larval development was high. Only 38,6 % and 39,8 % respectively on leaf I and II reached maturity. These differences, only slightly in favour of leaf II, indicate that the quality of the food did not affect the mortality.

If we look at the duration of the larval period, we find a not very pronounced difference between the two lots. The mean developmental period is lengthened from about 21 days on leaf I to 22 days on leaf II. If however we take into account the great variability in the length of this period, ranging from 19 to 26 days, we cannot attach much importance to a mean difference of 24 hours.

The results of this experiment are computed in table 2.

Table 2.

		Duration of development from larva to imago Days								Mean developmental period
		19	20	21	22	23	24	25	26	
A.	Number of ♂	5	3	7	2					20.35 days
	Number of ♀		3	8	3	2	1			21.80 „
	Total number of both sexes	5	6	15	5	2	1			21.14 „
B.	Number of ♂	1	1	4	5	5	6	1	1	22.62 „
	Number of ♀		2	6	2	2	2	0	1	22.00 „
	Total number of both sexes	1	3	10	7	7	8	1	2	22.38 „

Duration of development of *Epilachna* larvae, from the hatching of the eggs to the emerging of the imagines. A. on leaf I. B. on leaf II.

We will not discuss the influence of the quality of the food on the duration of the larval period in general any further. In *Helopeltis,* the only difference was an increase of the larval mortality, whereas in caterpillars a definite lengthening of the period from egg to imago could be stated. We will see these results in the subsequent experiments, but as no general rule could be detected the mere mentioning of these facts must suffice.

We will now turn to the imagines reared in the foregoing experiment. They are of two kinds, those fed on leaf I and those grown on leaf II. As a matter of course they were kept separate. Half the number of the females originating from larvae kept on leaf I were fed with leaf I, the other half with leaf II. The females of the other lot were dealt with in the same way. At the end of the experiment it became evident, that in this case the quality of the larval food did not have any influence on the longevity and the fecundity of the adults. We will not therefore consider them separately here.

To these females were added 10 females from another stock, fed with fresh leaves, which were given leaf III as food, so that at the beginning of the experiment we had:

15 females kept on leaf I
16 „ „ „ „ II
10 „ „ „ „ III

Each female was placed in a glass vessel, such as had been used in rearing the larvae, and was allowed to mate. If the male died before the female, it was replaced by another one, so that cessation of oviposition, or sterility of the eggs could not be attributed to the absence of males. *Epilachna* copulates frequently in nature as well as in captivity, and continues to do so to the end of life.

Oviposition (in captivity) commenced as a rule on the 11th to 16th day of imaginal life and might go on uninterruptedly till death. Normally the eggs

were laid once a day about the first hours of the noon. Their number ranged from 1 to 46.

For some reason as yet unknown a couple of females did not oviposit. We find such individuals in nearly every experiment. Perhaps they ought to be excluded when computing the results. If it had been done in this case, the differences between I and II would have been still more striking.

As it might be possible that the unability to oviposit was due to the sterility of the male, these were replaced in such cases by other males that had already successfully mated with other females.

In table 3 we find in a condensed form the results of this experiment, while in figure 1 egg-production is shown grafically.

The complete figures are given in table 4.

Table 3.

	Quality of the food		
	leaf I	leaf II	leaf III
Mean total number of eggs	356.—	261.75	134.—
Mean number of egg-cluster	20.5	16.55	13.41
Mean duration of imaginal life (in days)	36.2	40.6	39.7
Mean number of days on which the ♀♀ oviposited	17.6	15.8	10.—

Results of rearing *Epilachna* on different kinds of food (computed from the figures given in table 4).

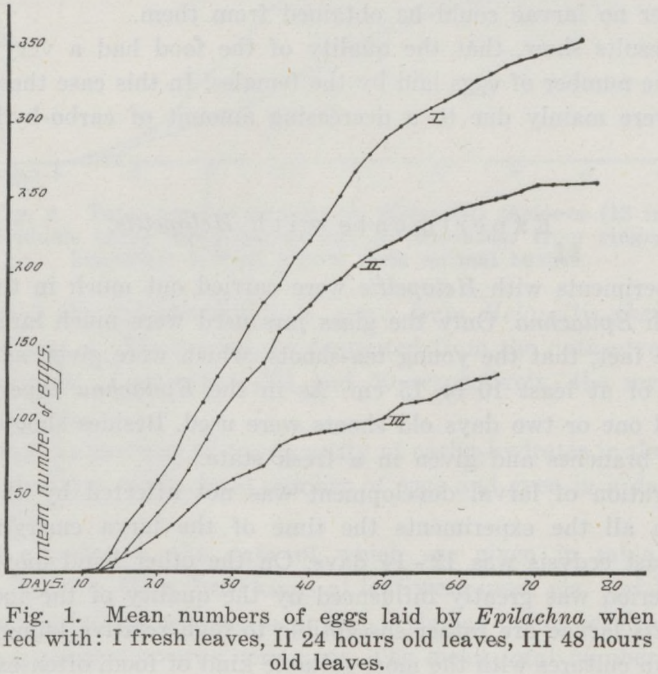

Fig. 1. Mean numbers of eggs laid by *Epilachna* when fed with: I fresh leaves, II 24 hours old leaves, III 48 hours old leaves.

We find that the duration of imaginal life is not or hardly affected by the quality of the food. Neither is the number of days elapsing from the beginning of oviposition towards the end of life. On the contrary, the number of days on which the female really oviposits diminishes from a mean of 17 and 16 days on leaf I and II to 10 on leaf III. In the same time the number of eggs laid dayly decreases from a mean of 14.8 and 10.1 to 5.7. The same is true for the number of eggs laid by one female. It may range from 1 to 46 a day, but the means on the different kinds of leaf are 20.5, 16.55 and 13.41 respectively.

Full evidence of this decreasing fertility is given by the total number of eggs. On leaf I this is 356, on leaf II this number is 262, whereas on leaf III it is only 134. The absolute numbers range on leaf I from 0 to 1149. On leaf II from 0 to 560 and on leaf III from 11 to 391.

The course of the egg-production is plotted in figure 1 where the mean subtotals of every second day are given.

During the first twenty days of oviposition there is not much difference between I and II, I being always a two-days egg-production in advance of II. But then gradually the differences become more and more pronounced and the result is, that the females fed with the fresh leaves yield some 36 % more eggs than those on one day old leaves. Looking at the curve, which represents the egg-production of the animals on leaf III, we see at a glance, that fertility is greatly reduced.

In conclusion we may add, that the eggs laid by the females on I and II all hatched, whereas on leaf III the number of dumb eggs gradually increased. The first twenty days of oviposition a certain number of eggs would hatch, but thereafter no larvae could be obtained from them.

These results show, that the quality of the food had a very definite influence on the number of eggs laid by the females. In this case these differences in quality were mainly due to a decreasing amount of carbo-hydrates in the leaves.

Experiments with *Helopeltis*.

The experiments with *Helopeltis* were carried out much in the same way as those with *Epilachna*. Only the glass jars used were much larger (4000 cc) owing to the fact, that the young tea-shoots, which were given as food, had a total length of at least 10 or 15 cm. As in the *Epilachna* experiments fresh material and one or two days old shoots were used. Besides shoots were taken from ringed branches and given in a fresh state.

The duration of larval development was not affected by the quality of the food. In all the experiments the time of the larva emerging from the egg to the last ecdysis was 12 - 14 days. On the other hand mortality during the larval period was greatly influenced by the quality of the food.

Helopeltis larvae are rather susceptible to high relative humidity, so mortality, even in cultures with the most suitable kind of food, often exceeded 30%.

If fed on leaf II, this percentage would go up to 70 or even 90 and on leaf III in every case it was 100. No larvae could be reared on tea-shoots that had been kept for 48 hours in the laboratory. On leaf A the mortality was about 50%.

The quality of the food as offered by leaf II and III thus proved to be unsuitable for rearing the larvae. But not only the larvae died on these leaves. The imagines too succumbed in due course. Fed on leaf III they would die within 10 days, without laying any eggs. Fed on leaf II duration of life was maximal 23 days, but the number of eggs would still be small. Only in one kind of experiment better results could be obtained.

Very soon after the last ecdysis copulation takes place and the mature female may even start ovipositing on the third day, continuing to do so to the end of life.

As a rule the first eggs are laid on the sixth day or even later still. By means of an ovipositor the eggs are sunk into the tea-stalk, and only two tiny hairs arising from the surface betray its place. Temperature records are much the same as in the experiments with *Epilachna*, so there is no use to give them here.

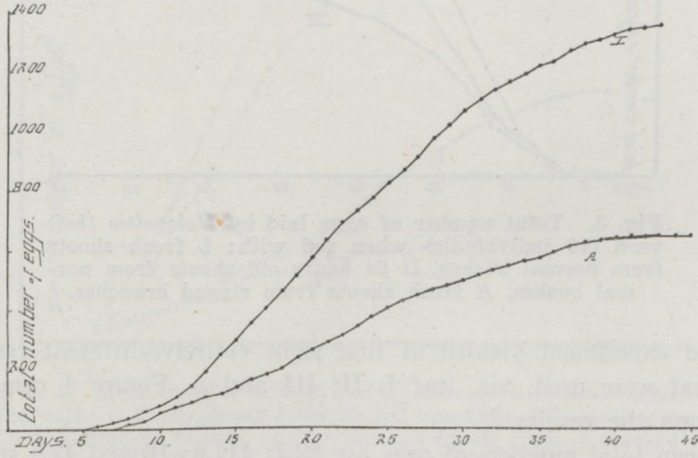

Fig. 2. Total number of eggs by *Helopeltis theivora* (13 individuals each) when reared on: A. tea-shoots from ringed branches; I fresh shoots form normal bushes.

In figure 2 the egg-production is given from *Helopeltis theivora* feeding on leaf I and leaf A. The curves are computed from the data given in table 5. The mean number of eggs was 104 and 50 respectively, the mean longevity 34.8 and 28.8 days.

We see that an increase of the quantity of carbo-hydrates in the food results in a definite decrease of the total number of eggs and even in a decrease of the duration of life.

Another experiment, the data of which are given in table 6 is shown grafically ni figure 3. Here three kinds of leaf were used, viz. leaf I, leaf A and leaf II. As in the foregoing experiment leaf I yielded better results than leaf A. On leaf II egg-production was very poor. The mean total number of eggs was

64.1, 41.8 and 23.25 on leaf I, A and II respectively. Duration of life in the same order 24; 20.6 and 15.2 days.

Compared with leaf I, leaf A has a greater, leaf II a smaller amount of carbo-hydrates. We find, that in both cases egg-production as well as duration of life decreases. An explanation of this phenomenon is only possible if we also take into account the available amount of albuminoids.

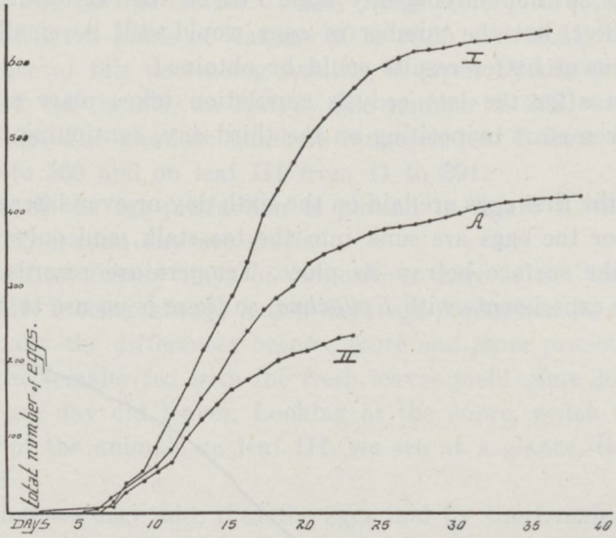

Fig. 3. Total number of eggs laid by *Helopeltis theivora* (10 individuals) when fed with: I fresh shoots from normal bushes, II 24 hours old shoots from normal bushes, A fresh shoots from ringed branches.

A third experiment yielded at first sight entirely different results. Four kinds of leaf were used, viz. leaf I, II, III and A. Figure 4 compiled from table 7 shows the results.

The mean total numbers of eggs are 82.7; 111.6; 18 and 42.4 respectively, the longevity 25.7; 36.3; 15.6 and 26.6 days. In the other experiments it was always leaf I that gave the best results in rearing *Helopeltis*, but here we find that leaf II is much better than leaf I and even that leaf III is not so bad as might be deduced from the other experiments.

To a good understanding of these facts it is necessary to enter into some details. The quality of the tea-shoots offered as food to *Helopeltis* is apt to vary considerably throughout the year. These variations are partly due to the changing of the monsoons, but for the greatest part they find their origin in changes which occur in the bushes themselves.

Every second year the tea-bush is pruned down. The picking of the leaves used for the manufacturing of tea is started some months after this pruning and continues until the bushes become too high, thus are ready for the following pruning. It is evident that the intensity with which the picking of the leaves takes place, must exert some influence on the tea-bush. Eventually, when the

plucking were too severe the bush would die in the long run. On the other hand if leafpicking was stopped for some time, the bush is not stimulated to form new off-shoots and will then proceed to form starch reserves in the wood of roots and stems. This was the case in our experiment where four kinds of leaf were included. The shoots, with the exception of leaf A, originated from un-

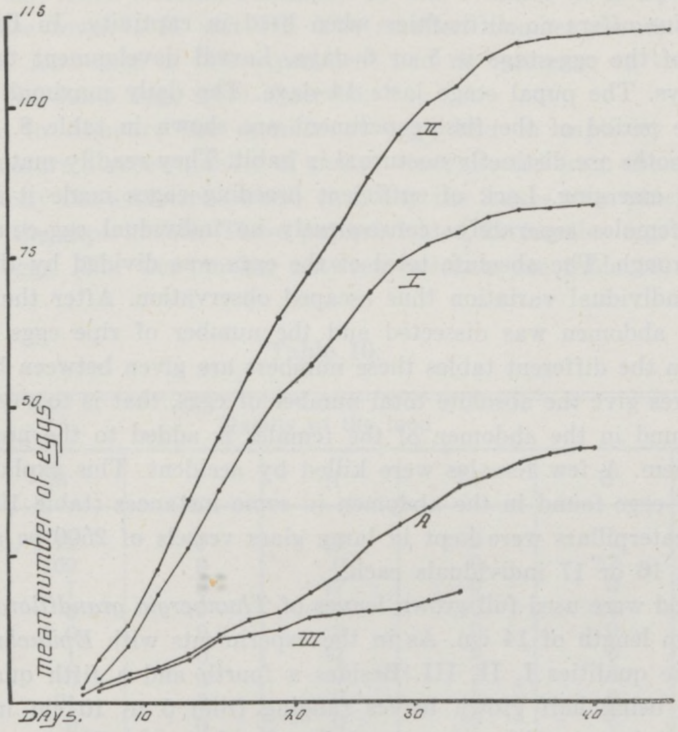

Fig. 4. Mean number of eggs laid by *Helopeltis theivora* when fed with: A fresh shoots from ringed branches, I fresh shoots from unplucked bushes, II 24 hours old shoots from unplucked bushes, III 48 hours old shoots from unplucked bushes.

plucked bushes, thus giving quite another quality of food to *Helopeltis* than those from normally plucked gardens.

In the experiments with *Epilachna* we found, that a decreasing amount of carbo-hydrates in the food resulted in a decreasing fertility of the adults. Here we are acquainted with a new fact. Starting from what we might call an optimum of the carbo-hydrates a decrease as well as an increase of the quantity of the carbo-hydrates results in a decrease of the total number of eggs. The second fact is important from the economic point of view. We found that rearing *Helopeltis* on shoots taken from bushes which were left unplucked for some time gave results, that differed entirely from those obtained on leaves originating from normally plucked bushes.

This is an indication that the differences in insect attack, which we some-

times observe even in adjacent plots may be due to differences in the plants, that is, in the composition of the food they offer to the insects.

The experiments with *Tinolius* and *Diacrisia* will show us other examples of this kind.

Experiments with *Tinolius*.

Tinolius offers no difficulties when bred in captivity. In Buitenzorg the duration of the egg-stage is 5 or 6 days. Larval development takes place in 26 - 48 days. The pupal stage lasts 14 days. The daily maximal temperatures during the period of the first experiment are shown in table 8.

The moths are distinctly nocturnal in habit. They readily mate and oviposit soon after emerging. Lack of sufficient breeding cages made it impossible to keep the females separately; consequently no individual egg-counts could be carried through. The absolute total of the eggs was divided by the number of females. Individual variation thus escaped observation. After the females had died, the abdomen was dissected and the number of ripe eggs it contained, counted. In the different tables these numbers are given between brackets. The other figures give the absolute total number of eggs, that is to say, the number of eggs found in the abdomen of the females is added to the number of eggs laid by them. A few females were killed by accident. This explains the great number of eggs found in the abdomen in some instances (table 10).

The caterpillars were kept in large glass vessels of 2500 cc solid content, containing 16 or 17 individuals each.

As food were used full grown leaves of *Thunbergia grandiflora* ROXB., with a minimum length of 14 cm. As in the experiments with *Epilachna* they were used in the qualities I, II, III. Besides a fourth and a fifth quality was included by using half grown leaves ranging from 5 to 10 cm in length and very young leaves with a maximal length of 4 cm. These are the leaves M and J.

In contradistinction with the results obtained in the experiments with *Epilachna* and *Helopeltis* we find here a very definite influence of the quality of the food on the duration of the larval development. We need not be surprised at this. Most caterpillars are very susceptible to changing conditions whatever they may be, and the length of the larval developmental period consequently is very variable. Even in lots where circumstances were likely to be much the same a fortnight might elapse between the first and the last moth emerging from the cocoon.

It is not improbable that crowding has played an important role here.

Table 9 shows the number of moths that emerged each day. There is not much difference between J, M and I, although if plotted graphically, J would show a slight retardation compared with I and M, II and III show a very definite lengthening of the developmental period of about 5 to 6 days. Experiments with *Diacrisia* showed similar results. There leaf II gave the shortest developmental period. It turned out in every experiment with *Tinolius* as well

as with *Diacrisia,* that the food that gave the highest egg-production showed at the same time the shortest developmental period. For the present we will confine ourselves to the mentioning of these facts and refrain from a further discussion.

Turning now to the egg-production of the female moths, we find (table 11), that there is not much difference between M and J. Same as in *Epilachna* we find a decrease towards II and III. The smallest number occurs in J. The quality of the food used in this experiment had no influence on the hatching of the eggs. No dumb eggs were observed.

In order to compare the number of eggs laid in captivity with that produced in nature a great number of pupae was collected from the same food-plants on exactly the same spot where each day the leaves were plucked, which were used in the experiments. These pupae yielded 21 females together laying 11616 (114) eggs. (For the number between brackets see table 10).

Table 10.

Quality of the food						
J	M	I	II	III	B	B'
0	12	5	10	0	0	25
0	109	0	0	0	52	72
0	7	0	17	0	0	3
0	0	10	1	0	24	0
0	0	0	5	0	0	0
0	1	0	12	9	0	0
0	0	0	0	7	19	0
0	21	2	0	3	0	0
0	0	0	0	0	0	0
0	200	11	0	0	0	0
	97	2	0	0	0	0
	165	0	11	35	11	0
	193	0	1	4	1	1
	147	0	0	0	7	0
	0		0	23	0	6
	3		0	8	0	0
	0			7	0	0
	0			0	0	0
				0	0	3
				0	0	0
				0	0	
				0		
				0		
				0		
				0		
0	955	30	57	96	114	110

Number of ripe eggs found in the ovary after dissecting the abdomen of the dead females. B = moths from pupae found in the *Thunbergia* hedge, B' = moths from pupae found on normally growing plants.

Table 11.

Quality of the food	Number of ♀♀	Total number of eggs	Mean number of eggs per ♀
J	10	1667	167
M	18	6010 (955)	344
I	14	4598 (30)	329
II	16	4193 (57)	262
III	24	5048 (96)	210

Number of eggs laid by *Tinolius* on different kinds of food. For the numbers between brackets see table 10.

This is 552 for each female or about 200 more than in the most favourable food-conditions in the laboratory. It may be due to several causes, more suitable climatic circumstances and better food. (The chemical composition of the leaves probably changed immediately as soon as they were separated from the plant). The chief reason however will be, that captivity had a very marked effect on the rate of food consumption. The amount of food taken by the caterpillars in captivity, living under experimental conditions is appreciable much less than in nature.

Towards the end of this experiment I came across the original stand of *Thunbergia* in the Botanical Gardens, where the plants were allowed to climb high up into the trees. The leaves which were used in the experiments were gathered from *Thunbergia* growing as a hedge which was pruned down as soon as it grew too high.

It looked as if the plants on the original stand were far less affected by *Tinolius* than the hedge-plants. A more careful examination seemed to confirm this first impression, because there were far more injured leaves on the hedge than here. As it was too late to include the leaves into the experiment, a great number of cocoons was collected. From 20 of these emerged females, which in due course laid 8255 (110) eggs, giving a mean of 418 eggs for each female. This is 139 less than the number of eggs laid by the moths feeding on the hedge. It is hardly possible that the micro-climatic differences could account for this. The places where the plants grew were only 200 m apart, the diversity in temperature and in relative humidity could only be slight. The insolation of the hedge was more intense, but it is highly improbable that these direct climatic influences on the caterpillars were large enough to affect the egg-production on such a scale. Thus the most probable explanation was to assume a marked diversity in the quality of the leaves. Experiments with *Diacrisia* subsequently proved that this assumption was right.

The following experiments merely confirmed the results which were obtained in the first one. As a rule leaf M yielded slightly better results than

leaf I, but not always. Table 12 shows an experiment where feeding with leaf I gave more eggs. The difference as a whole is small and not very convincing. On the very young leaves only one female emerged from the pupae. This is not due to an extremely high mortality, but to the fact, that the 11 other moths were males.

Table 12.

Quality of the food	Number of ♀♀	Total number of eggs	Mean number of eggs per ♀
J	1	100 (61)	100
M	8	1887 (76)	236
I	5	1220 (90)	244
II	13	2385 (218)	183
III	7	1071 (412)	167

Number of eggs laid by *Tinolius* on different kinds of food (27-X-37); numbers between ( ) are the eggs found in the ovary after the moth had died.

Experiments with *Diacrisia*.

The experiments with *Diacrisia* were run in exactly the same way as those with *Tinolius*. The caterpillars are rather polyphagous. They feed also on *Thunbergia*, but whereas *Tinolius* is found on the younger leaves, *Diacrisia* prefers the older ones.

Experiments were started with some 200 eggs found on a leaf of *Thunbergia grandiflora* in the Botanical Gardens. After hatching the larvae were kept on fresh full-grown leaves for 12 days. Then they were divided into 5 lots containing 40 caterpillars each and kept in glass vessels of 2500 cc solid content. The five different kinds of food were again I, II, III, M and J leaves from *Thunbergia grandiflora*.

No difficulties in rearing were met with, excepting the caterpillars kept on leaf J. Indeed of the 160 caterpillars kept on leaf I, II, III and M 159 gave moths. Rearing on leaf J was not so successful. When most of the caterpillars of the other groups had pupated, these had only reached half the size of the full-grown larvae. Therefore, on the 33 day after hatching, the food was changed again into fresh fullgrown leaves. Of the 40 caterpillars only 27 pupated. 18 of these pupae gave moths. The retardation in the development amounted to 10 or 11 days.

Working with *Diacrisia* is very convenient. The moths are completely nocturnal in their habits, simulating death in daytime even when they are touched and moved from one vessel to another. They copulate and oviposit freely in captivity and the total number of eggs will perhaps exceed one thousand if the caterpillars are kept on suitable food in proper conditions.

In the Buitenzorg climate the egg-stage lasts 5 to 6 days. Larval development takes place in 25 to 35 days, whilst the pupal stage takes 11 to 12 days.

As in the experiments with *Tinolius* no individual egg-counts could be made. After the females had died the abdomen was dissected and the ripe eggs in the ovary counted. In the different tables their numbers are placed between brackets. During the first experiment many moths were put into the alcohol by mistake. The animals simulated death so completely, that the error appeared only when it was too late.

Table 13.

Quality of the food	Number of ♀♀	Total number of eggs	Mean number of eggs per ♀
I	27	13810 (708)	511,5
II	17	10638 (495)	625.8
III	18	9888 (876)	549.3
M	20	9167 (855)	458.3
J	7	1689 (706)	241.3

Number of eggs laid by *Diacrisia* on different kinds of food (8-X-37). The number between ( ) are the eggs in the ovary after the death of the female.

The results of this first experiment are shown in table 13. During the first 12 days of larval life the caterpillars were fed with fresh full-grown leaves. In the following experiment the different kinds of food were given immediately after the hatching of the eggs. As could be expected from the results of the first experiment, rearing on leaf J was impossible. But not only leaf J, leaf M also proved to be very unsuitable as food for the young caterpillars. Mortality directly from the beginning was very high and eventually from the 50 larvae only 8 pupated, but gave no moths.

On the leaves I, II and III also rearing was not so successful as it had been in the first experiment. As a matter of fact more than 50 % of the caterpillars died before they were able to pupate. This was due to a change in the climate. During the first experiment temperature had been rather high and relative humidity low. Then a change occurred and the next two months a rather wet period was experienced, with a temperature that was approximately 1½ or 2 C⁰ lower than in the proceeding period. The high relative humidity combined with very turgescent leaves, which were not completely dry on the surface, made the caterpillars very susceptible to fungous attack.

The results as to the total number of eggs are rather poor. The differences between I, II and III are still more striking than in the foregoing experiment. But they are computed from a much smaller number of individuals and therefore not so convincing.

Table 14.

Quality of the food	Number of ♀♀	Total number of eggs	Mean number of eggs per ♀
I	11	3137 (489)	313.7
II	8	3824 (183)	478.—
III	15	4313 (1280)	287.5

Number of eggs laid by *Diacrisia* on different kinds of food (22-XI-37). The numbers between ( ) are the eggs contained in the ovary after the female had died.

If we compare the results with those obtained in rearing *Tinolius,* we find a striking difference. In *Tinolius* the best results were obtained on the young and on the full-grown leaves, whereas *Diacrisia* could not or hardly be brought to maturity on the young and half-grown leaves. This is about what could be expected from the differences in the life habits of the caterpillars in nature. *Tinolius* being found on the young leaves, *Diacrisia* on the older ones. That however in *Diacrisia* leaf II and not leaf I should turn out to give the best results was rather something like a surprise. Looking at the figures of table 13, we find that not only II gives more than 100 eggs more than I but that even III surpasses I with a mean of 38 eggs.

Table 14 shows us slightly different results in so far that now I gives 26 more eggs than III. The differences between II and I are still more striking. It is remarkable that in III 2 moths evidently failed to oviposit and that 4 more only laid a certain part of their eggs. The number of eggs contained in the ovary of each individual moth are: 294, 324, 184, 202, 204, 72, 13, 15, 7, 3, 0, 0, 0, 0, 0. This is very exceptional. Although in every group of individuals we may find one or two with one hundred or more eggs, the majority have none or only very few. The cause of this phenomenon is unknown. As a result of these two experiments (and a third merely confirmed them) we find that the best kind of food for the caterpillars of *Diacrisia* is offered by leaf II. When fed with leaf I or with leaf III the number of eggs falls down sharply. Between these two kinds of food there is not much difference. In the first experiment leaf III gave the better results; in the second one feeding with leaf I gave more eggs.

About the same time as the second experiment a large scale experiment was run, including some 600 caterpillars divided into 6 different lots. This experiment was started a fortnight earlier, so that the young caterpillars did not suffer from the extreme wetness, that proved so fatal to many larvae some 20 days later. The change of the weather did not affect the half-grown caterpillars to such an extent, alhough in one case mortality was as high as 31 %.

As mentioned in the description of the experiments with *Tinolius* the female moths reared from pupae collected in nature from a *Thunbergia* hedge gave appreciably more eggs than those collected from the free growing *Thunbergia* plants. Leaves of the hedge-plants and of the normally growing plants were

included into one experiment, and as lack of suitable glass vessels did not allow me to use more than 6 different kinds of food, the half-grown leaves (M) were omitted. The results are shown in table 15. A represents the leaves taken from the hedge, B those from the free-growing plants.

Table 15.

Quality of the food		Number of ♀♀	Total number of eggs	Mean number of eggs per ♀
	I	31	13880 (529)	447.7
A	II	40	21329 (811)	533.2
	III	37	15523 (767)	419.5
	I	39	14352 (485)	368.—
B	II	41	18020 (680)	439.5
	III	29	14231 (533)	490.7

Number of eggs laid by *Diacrisia* on different kinds of food (8-XI-37). The numbers between ( ) are the eggs contained in the ovary after the female had died.

In A we find the same results as in the two foregoing experiments. Here again I gives slightly more eggs than III. II is distinctly better.

B shows us quite different results. Compaired with A, I and II show a decrease of the mean number of eggs. In I this is about 80, in II more than 90. Considering the behaviour of the moths of *Tinolius* on these two plants, we might have expected such a decrease. If we look however at the number of eggs laid by the female moths grown upon leaf III we find instead of a decrease a very definite increase of the mean number of eggs. III reaches nearly the same level as II in the A series.

In B we find an increasing number of eggs from I to III, whereas in the other experiments this order was III-I-II or I-III-II. The experiments in B thus give us results, that are just the reverse from what we found in *Epilachna* and in *Tinolius*. There a decreasing quantity of carbo-hydrates gives an increasing number of eggs, here a decreasing quantity gives an increasing number of eggs. The other experiments with *Diacrisia* show agreement with those with *Helopeltis*, where we found that a decrease in the quantity of the carbo-hydrates gave at first an increase of the number of eggs, followed by a decrease. The successive series II-I-III in *Diacrisia* is the same as I-A-II in *Helopeltis*.

Discussion.

If we review briefly the results described above, we find, that the differences in fertility are in most cases very pronounced. These differences are entirely due to the changing quality of the food.

The first conclusion therefore is, that the influence of the quality of the food under experimental conditions is large enough to be of interest to the economic entomologist.

Are these differences also large enough in nature?

We are allowed to answer this question in the affirmative.

In our experiments the following facts were brought to light.

In *Tinolius* we found a difference of about 150 eggs between the individuals feeding on the same kind of food-plants, but which were growing on different localities. The like was found true when rearing *Diacrisia* on the same kinds of leaf.

In *Helopeltis* we saw, that in some cases leaf I, in other cases leaf II would give the better results. These leaves came from quite different plots in the garden, the one being plucked normally, whereas the other was left unplucked.

We might further draw attention to the work of MAHDIHASSAN on lac. Although not procuring exact data on the correlation between the food and the fertility of the insects, it is quite obvious that the quality of the food is the most important factor in lac-production.

It is possible to cite a great many more authors on economic-entomological subjects, all supporting the idea, that the food may have played an important role in the gradation of the pest. The few examples however will have made it clear enough, that the differences in the total number of offsprings are so great, that they will account for nearly every change in the total number of individuals of the insect populations, that may occur in nature. We will not pretend that these changes in every case will be due to food-effects, but in many cases they are.

At any rate we come to the conclusion that the plants growing on different localities (be they even adjacent), may have a distinctly different food value for the animals feeding on them, so that consequently the concerning insects show great diversity in their fertility.

Considering our figures, they warn us, that we must be very careful with the interpretation of field observations. So in many localities in Java during the dry season different kinds of mealy bugs increase their numbers to an astonishing amount. As a rule it is thought, that this is due to climate influences, viz. higher temperature and lower relative humidity, but as the plants themselves undergo the influence of the dry monsoon too, we have the same right to ascribe the flourishing of the mealy bug family to favourable food conditions e.g. higher carbo-hydrate content. It is obvious that in such cases only careful laboratory experiments can tell us which part is due to the direct climatic influences and which part to food-effects.

Another point we may draw attention to is the fact, that different species react differently on the same kind of food. In our experiments we saw already one example in the cases of *Tinolius* and *Diacrisia*. As in nature the first species shows a preference for the younger leaves, the latter for the older full-grown ones, it was not very surprising that *Tinolius* was most fertile on young leaves (leaf M) and *Diacrisia* on older ones. If we only take into consideration the leaves I, II, III, we find that *Tinolius* shows decreasing fertility in this order,

whereas in *Diacrisia* (in one instance) the total number of eggs increased using the same leaves in the same order.

Another example of this is found when rearing *Toxoptera aurantii* B. D. F. on tea. If we compaire the life habits of this species with those of *Helopeltis* we find, that they both feed on the same kind of leaves, that is to say on the young shoots and even on the expanding buds. Nevertheless we seldom find the two species together on the same plant.

In one experiment *Toxoptera* was reared simultaneously with *Helopeltis* and on exactly the same kind of food. The results for *Helopeltis* have been discussed above, they are shown in figure 4 and in table 7.

In table 16 the mean totals are given again, together with those obtained when rearing *Toxoptera*.

Table 16.

Quality of the food	Mean number of offsprings *Helopeltis*	*Toxoptera*
A	42,4	46.6
I	82,7	46,6
II	111.6	12.2
III	18.—	0.—

Mean total number of offsprings of *Helopeltis* and of *Toxoptera* grown on four different kindts of tea-shoots.

The fertility of the insects on the different kinds of food disagrees in every point, excepting perhaps that the lowest fertility in both cases is found on leaf III.

As the two species are found on exactly the same spots in the tea-bushes and thus probably suck the same kind of juices, this example clearly shows us, that every species reacts on the different food-qualities in its own specific way.

If we now turn our attention to the differences in the quality of the food, we will for the present rule the young and the half-grown leaves (J & M) out and confine ourselves to the leaves I, II, III and A.

Leaf I was taken every morning from plants growing in the garden and given as food to the insects immediately. Part of the leaves plucked were kept in the laboratory for 24 or 48 hours, before they were used as food, thus giving the leaves II and III. Leaf A was obtained by ringing a branch and using the leaves growing above this wound as food.

Starting from leaf I as the normal kind of food, leaf II and leaf III differed from it by a diminishing content of carbo-hydrates. Whatever might be the chemical composition of leaf I, leaf II always contained less carbo-hydrates and in leaf III this quantity was still smaller. On the other hand, leaf A as compared with leaf I always showed an increase of the carbo-hydrates content. In the experiments where these four kinds of leaf were used we had consequently a series of food with diminishing quantities of carbo-hydrates from A via I to III.

If we pass under review the results of our experiments in regard to the carbo-hydrate content of the leaves, we find:

1) In *Tinolius* a decreasing fertility when using the leaves I-II-III.
2) In *Epilachna* a decreasing fertility when using the leaves I-II-III.
3) In *Toxoptera* a decreasing fertility when using the leaves A-I-II-III.
4) In *Diacrisia* an increasing fertility when using the leaves I-II-III.
5) In *Helopeltis* an increasing, after that a decreasing fertility when using the leaves A-I-II-III.
6) In *Diacrisia* an increasing, after that a decreasing fertility when using the leaves I-II-III.

Or in other terms:

when the quantity of the carbo-hydrates in the food diminishes the fertility of the insects:

1) decreases in *Epilachna, Tinolius, Toxoptera.*
2) increases in *Diacrisia.*
3) increases, after that decreases in *Helopeltis* and *Diacrisia.*

It is clear, that if we try to explain these facts, it is absolutely necessary to take at least into consideration the available amount of albuminoids. It will be seen by the discussion of the manuring experiments (in a subsequent paper) that the ratio between the carbo-hydrates and the albuminoides in the food plays an important role, although things are largely complicated because the quantity of the food taken by the insects is not the same when using different kinds of leaf.

For the present we will simply draw attention to the fact, that the available amount of carbo-hydrates plays an important role, and that somewhere there seems to be an optimum, different for each separate species, on which the insects thrive best.

Buitenzorg, February, 1 1938.

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Tabel 1.

Temperature during the months of September and October 1936.

date	hour	temp. C°	hour	temp. C°	hour	temp. C°	date	hour	temp. C°	hour	temp. C°	hour	temp. C°
Sept. 9	7^{30}	27.—	11	29.5	14	30.25	Oct. 1	7^{30}	25.75	11	28.25	14	30.5
10	7^{30}	26.25	11	29.—	14	29.75	2	7^{30}	26.—	11	28.75	14	30.25
11	7^{30}	25.75	11	28.—	14	29.75	3	7^{30}	26.—	11	29.5	12^{30}	30.—
12	7^{30}	26.—	11	28.—	12^{30}	29.5	4	8	27.—	10^{30}	29.25	—	—
13	8	26.25	10^{30}	28.—	—	—	5	7^{30}	26.75	11	29.—	14	30.25
14	7^{30}	26.5	11	28.—	14	29.5	6	7^{30}	26.—	11	18.75	14	30.5
15	7^{30}	26.—	11	28.—	14	28.75	7	7^{30}	25.75	11	29.—	14	29.—
16	7^{30}	25.5	11	27.75	14	29.5	8	7^{30}	26.75	11	29.—	14	29.—
17	7^{30}	25.75	11	28.—	14	29.—	9	7^{30}	25.5	11	28.—	14	29.75
18	7^{30}	26.—	11	28.75	14	30.5	10	7^{30}	25.75	11	28.75	12^{30}	29.—
19	7^{30}	25.75	11	29.—	12	29.—	11	8	27.—	10^{30}	29.—	—	—
20	8	26.75	10^{30}	28.—	—	—	12	7^{30}	26.—	11	29.25	14	30.—
21	7^{30}	25.25	11	28.—	14	29.25	13	7^{30}	25.75	10^{30}	29.—	—	—
22	7^{30}	25.—	11	28.—	14	29.75	14	7^{30}	25.5	11	29.5	14	30.—
23	7^{30}	26.—	11	28.75	14	29.5	15	7^{30}	25.75	11	29.—	14	29.—
24	7^{30}	26.—	11	29.—	14	30.5	16	7^{30}	26.—	11	27.—	14	28.—
25	7^{30}	26.75	11	29.25	14	30.75	17	7^{30}	26.—	11	26.75	12^{30}	28.25
26	7^{30}	26.25	11	29.—	12^{30}	30.—	18	8	25.75	10^{30}	26.—	—	—
27	8	27.—	10^{30}	28.5	—	—	19	7^{30}	26.25	11	27.50	14	28.—
28	7^{30}	26.25	11	29.—	14	30.75	20	7^{30}	26.5	11	28.—	14	29.75
29	7^{30}	26.—	11	28.5	14	30.—	21	7^{30}	25.75	11	29.—	14	30.—
30	7^{30}	26.—	11	28.—	14	30.5	22	7^{30}	26.25	11	28.25	14	28.75
							23	7^{30}	26.—	11	28.5	14	29.—
							24	7^{30}	26.25	11	27.—	12^{30}	28.—

Table 8.

Maximal temperatures in the laboratory during the month of January, February and March 1937.

date	temperature C°	date	temperature C°	date	temperature C°
10 I 37	26.25	3 II 37	26.25	27 II 37	29.25
11	26.25	4	28.—	28	29.—
12	28.5	5	28.—	1 III 37	28.75
13	29.75	6	26.25	2	29.—
14	29.—	7	26.75	3	29.75
15	27.5	8	27.—	4	28.—
16	28.—	9	26.5	5	27.5
17	27.5	10	28.75	6	29.—
18	26.5	11	27.5	7	29.—
19	26.75	12	27.—	8	29.25
20	27.75	13	27.—	9	29.75
21	28.5	14	27.5	10	27.5
22	29.5	15	29.—	11	28.75
23	29.—	16	28.75	12	29.—
24	29.5	17	29.5	13	28.5
25	26.25	18	29.—	14	29.5
26	29.75	10	29.—	15	29.75
27	28.—	20	29.25	16	28.75
28	29.75	21	29.—	17	29.—
29	29.5	22	29.—	18	29.5
30	29 —	23	29.5	19	29.75
31	29.5	24	29.—	20	29.75
1 II 37	30.—	25	29.5		
2	26.5	26	29.—		

Table 9.

DATE	Quality of the food									
	J		M		I		II		III	
1 III 37	2 ♂		1 ♂							
2	2 ♂		1 ♂		2 ♂					
3	2 ♂		2 ♂	2 ♀						
4	1 ♂		6 ♂	2 ♀	8 ♂					
5	1 ♂		2 ♂	2 ♀	2 ♂		2 ♂			
6	2 ♂		1 ♂	2 ♀	4 ♂		2 ♂		1 ♂	
7		2 ♀	3 ♂		2 ♂	2 ♀		2 ♁	1 ♂	
8		1 ♀		4 ♀	3 ♂	2 ♀			4 ♂	
9	3 ♂		2 ♂		3 ♂	2 ♀	3 ♂	2 ♀	1 ♂	1 ♀
10	1 ♂						2 ♂		3 ♂	3 ♀
11	2 ♂		3 ♂	1 ♀		2 ♀	1 ♂			
12	1 ♂	3 ♀	1 ♂	3 ♀		2 ♀	1 ♂	3 ♀	7 ♂	
13	2 ♂	2 ♀	2 ♂	2 ♀		4 ♀	3 ♂		5 ♂	2 ♀
14	1 ♂	2 ♀						5 ♀	1 ♂	3 ♀
15							1 ♂		2 ♂	3 ♀
16							3 ♂	2 ♀	1 ♂	1 ♀
17							2 ♂	1 ♀		3 ♀
18								1 ♀		5 ♀
19										3 ♀
Totals	20 ♂	10 ♀	24 ♂	18 ♀	24 ♂	14 ♀	20 ♂	16 ♀	26 ♂	24 ♀

Tinolius. Number of moths emerging each day.

Tabel 4.

No.	Quality of the food	Date	Number of eggs on each day of life.																																																																															Longevity days	Ovipositing period days	Total number of eggs
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80			
1	I (A)	2-X-36																13	15	—	8	7	—	—	26	—	14	13	11	—	18	14	27	24	19	21	21	—	15	26	12	—	35	—	33	13	37	27	28	14	23	20	39	—	22	30	16	27	16	29	25	16	26	27	20	27	27	20	25	19	25	22	22	29	20	31	28	27	†				76	61	1149
2		6																6	—	—	15	10	†																																																											20	5	31
3		7													5	10	—	18	20	—	—	†																																																											19	7	53
4		8													15	—	31	28	—	13	—	22	23	22	15	17	—	33	25	—	—	15	19	19	5	21	18	—	15	19	20	—	—	12	—	23	21	20	—	26	17	8	†																															50	38	518
5		8														14	—	3	—	—	7	17	4	—	8	22	10	17	2	19	—	—	8	—	†																																																32	19	131
6		8										†																																																																								9	0	0
7		10												15	—	18	12	—	—	—	—	—	18	—	11	9	23	16	—	—	11	11	—	12	30	13	31	11	—	31	12	20	12	—	18	17	—	—	19	11	23	9	†																															50	39	413
8		11								†																																																																													6	0	0
9	I (B)	2																	10	17	—	31	—	7	15	—	—	—	18	—	25	15	19	13	16	—	—	13	11	28	—	19	30	—	23	—	10	24	—	30	—	27	22	—	31	15	19	21	17	17	21	14	26	24	20	11	26	†															65	49	685
10		3														12	18	31	—	18	38	—	21	26	18	20	—	30	16	25	18	26	34	—	26	35	—	17	33	—	—	26	24	14	25	25	21	19	27	—	35	21	†																															50	37	699
11		5											12	—	—	—	26	†																																																																						15	5	38
12		9													21	26	35	—	19	23	20	22	—	32	22	15	—	21	32	20	28	—	32	33	32	—	41	—	35	9	46	—	39	23	—	46	†																																							44	32	672
13		12																14	15	—	8	—	25	—	24	14	1	28	15	20	†																																																							28	13	164
14		12													11	15	11	12	17	—	16	28	19	13	25	21	17	17	23	23	—	—	28	27	19	6	27	—	35	20	—	19	—	10	18	12	24	23	7	22	17	—	29	†																														51	39	611
15		12													19	—	12	28	—	10	—	9	—	—	20	22	—	20	17	19	†																																																										28	16	176
16	II (A)	1																			10	—	16	15	17	15	20	17	14	12	18	9	—	15	18	—	25	14	—	†																																													37	19	235
17		7									†																																																																												7	0	0
18		7													16	17	10	26	—	2	21	7	20	—	—	18	10	14	9	28	15	13	12	—	—	—	21	28	15	†																																																	37	25	302
19		7													19	13	21	—	18	22	16	27	—	—	29	—	19	23	19	11	17	—	33	1	38	—	9	26	17	—	19	23	—	21	†																																												42	30	441
20		8															10	—	17	6	—	—	9	—	21	—	—	13	—	19	†																																																										28	14	95
21		9																	21	†																																																																		17	1	21
22		10													6	—	—	21	7	—	—	—	—	—	8	10	—	29	16	—	—	12	—	—	—	—	14	3	†																																																		36	24	126
23		11																	10	12	—	—	—	—	8	—	26	—	—	—	—	30	—	11	5	2	11	15	12	—	4	—	—	22	—	—	20	22	—	20	13	11	—	12	13	21	—	15	—	29	—	—	—	13	—	—	25	9	—	23	7	15	20	—	—	—	—	—	7	†			77	61	463
24	II (B)	1																	19	—	—	17	—	—	24	—	30	25	29	20	—	—	24	18	16	21	22	—	23	16	8	—	25	—	10	19	19	—	25	†																																	47	31	390
25		2																	4	9	—	4	16	—	—	12	20	19	10	16	—	17	—	—	1	24	12	—	—	11	18	—	14	22	†																																												42	26	229
26		6																			7	12	15	13	5	—	13	—	—	—	—	—	—	—	—	—	23	—	—	14	6	—	17	24	23	—	15	—	13	—	—	16	15	—	—	14	—	23	27	—	11	—	—	†																			61	43	306
27		13																		5	14	20	13	—	16	20	13	21	—	15	†																																																								28	11	137
28		10													11	—	—	20	—	14	—	10	—	28	—	27	—	2	23	—	27	—	—	—	—	—	—	26	—	—	24	—	—	15	—	—	3	12	31	—	11	14	17	—	—	32	9	4	13	—	—	—	18	9	†																		62	50	410
29		11														4	23	10	†																																																																							16	3	37
30		12															13	18	—	17	12	21	13	—	24	—	23	—	25	—	30	—	21	25	15	21	—	35	16	18	22	—	17	—	25	24	†																																							44	30	435
31		13																	15	—	—	—	9	17	—	16	—	—	10	—	—	13	22	14	—	11	14	18	8	10	—	5	14	—	9	—	27	19	9	12	—	15	31	—	15	15	—	28	20	—	15	22	—	16	24	—	15	—	32	28	22	†											69	53	560
32	III	12																24	—	—	—	—	—	—	—	—	—	—	—	—	24	—	†																																																								30	15	48
33		15																			13	3	—	—	—	10	—	†																																																											25	7	26
34		13														37	—	8	—	25	6	16	—	—	9	11	25	—	†																																																														26	13	137
35		12																11	—	—	—	†																																																																				19	4	11
36		14																	7	9	—	9	—	—	13	9	6	—	9	—	—	†																																																								29	13	62
37		13																					8	—	16	6	—	1	—	—	—	—	3	8	—	—	24	1	—	—	—	—	—	12	—	—	—	14	10	1	4	—	32	—	—	12	—	—	—	—	14	—	†																			62	41	166
38		12												13	5	—	—	—	—	—	—	17	10	—	21	16	24	—	8	20	—	17	—	—	26	—	22	20	—	21	—	—	11	—	14	—	—	9	—	—	14	—	10	—	20	11	8	—	15	22	—	—	—	—	—	—	17	†															65	54	391
39		15																					4	—	4	—	—	—	—	19	2	26	—	—	—	30	—	18	—	—	†																																														39	18	103
40		13														17	3	2	12	—	—	—	16	9	—	11	13	—	—	20	—	—	—	22	—	8	14	20	11	—	11	†																																																39	26	190
41		14																			10	—	—	—	4	10	—	—	6	—	—	—	—	—	—	—	—	10	—	—	—	—	—	—	9	—	5	13	—	—	19	—	20	13	—	—	—	—	11	—	21	20	19	—	17	†																	63	45	207

Longevity and daily number of eggs of *Epilachna* on three kinds of food.

49	50	Longevity in days	Total number of eggs
		26	49
		10	0
		33	95
		41	141
		25	35
		40	68
		20	45
		11	6
		41	90
		36	22
		46	68
		15	23
		30	6
		41	100
		35	92
		22	10
		42	157
		38	143
		22	34
		37	123
		41	171
		11	0
		35	62
		39	119
		36	158
		43	181

Tabel 6.

Quality of the food	No.	Date	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	Longevity in days	Total number of eggs
			Number of eggs on each day of life.																																								
	1	19-II-34					1	2	2	1	6	9	9	6	4	4	6	12	5	7	3	3	3	†																		22	83
	2	21									2	4	4	4	2	0	3	7	6	5	5	4	5	6	7	3	2	3	†													27	72
	3	22								1	1	2	3	3	2	4	2	5	3	4	2	0	0	5	7	3	4	†														26	51
	4	22								1	3	1	2	7	6	3	5	6	5	5	†																					19	44
Leaf I	5	23					1	6	8	6	11	11	6	5	6	1	9	7	7	†																						18	84
	6	24					1	0	0	2	3	2	2	2	6	2	4	5	5	2	7	3	4	5	5	5	3	5	3	3	3	3	3	4	2	3	4	†				36	100
	7	24								2	2	3	3	1	0	6	3	4	0	0	0	0	0	0	0	0	†															25	24
	8	27						3	5	3	0	2	5	3	3	7	7	2	5	2	6	6	5	†																		22	64
	9	27						2	6	4	2	5	6	6	7	8	6	3	4	8	5	5	1	†																		22	78
	10	28									2	3	3	4	2	0	2	2	2	5	5	1	3	7	†																	23	41
	11	22						1	4	5	6	5	6	†																												12	27
	12	23							2	0	†																															9	2
	13	26							4	3	0	0	2	5	7	7	4	3	3	3	1	2	2	†																		22	46
	14	26							2	4	9	0	0	8	1	3	4	7	4	1	4	5	†																			21	52
Leaf II	15	27		1	1	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	†																					19	5
	16	27								1	0	3	†																													11	4
	17	28					1	3	3	1	6	10	8	8	1	†																										14	41
	18	2-III										3	1	2	3	†																										14	9
	19	19-II										3	2	0	2	3	0	0	†																							17	10
	20	22						5	4	3	2	4	4	5	6	5	0	8	2	3	4	4	1	3	7	†																24	70
	21	22									3	4	5	4	2	5	3	5	3	3	5	2	3	4	4	4	4	4	4	5	6	4	3	5	2	3	1	1	1	0	†	39	102
	22	23							3	1	0	2	2	1	1	1	5	2	1	1	5	†																				20	25
	23	24					1	3	7	4	5	3	5	8	4	5	6	6	7	4	10	4	4	†																		22	86
Leaf A	24	26											9	3	0	0	3	3	2	3	5	1	1	†																		22	30
	25	26					2	6	7	3	2	5	0	3	7	7	†																									15	42
	26	27								1	0	†																														10	1
	27	27									1	1	1	3	4	4	6	1	1	5	2	2	†																			21	31
	28	1-III									1	3	4	4	1	4	4	†																								16	21

Longevity and number of eggs of *Helopeltis theivora* on three kinds of food.

36	37	38	39	40	41	42	43	44	45	46	47	48	49	Longevity in days	Total number of eggs
														9	0
3	1	3	1	0	†									40	64
0	3	2	1	1	†									40	44
														15	4
														29	100
3	1	0	0	3	2	0	0	2	1	1	†			46	130
0	0	0	†											38	103
1	†													36	109
1	0	†												37	122
0	0	†												37	113
														31	105
														29	99
														32	113
														20	50
														26	40
1	1	0	2	1	1	1	†							42	178
														27	115
														7	0
†														35	57
														9	0
														9	0
														15	22
														10	11

inds of food.

MATERIALIEN ZU EINER REVISION DER *TAENIOTHRIPS*-ARTEN (THYSANOPTERA) DES INDO-MALAYISCHEN FAUNENGEBIETES.

Von

H. PRIESNER

(Cairo).

Im folgenden sollen ergänzende Beschreibungen alter und Beschreibungen neuer Arten gegeben werden, als ein Beitrag zu einer künftigen Revision der Gattung *Taeniothrips* Serv. Anschliessend wird eine Uebersicht über die bisher bekannten Arten aufgestellt, ferner werden einige Gattungen besprochen, die teils mit *Taeniothrips* vermengt, teils unscharf abgegrenzt waren.

Ich hatte Gelegenheit, grosse Serien durchzusehen, vor allem H. H. Karnys Sammlung, die des Buitenzorger Museums, die Typen D. Moultons, Cotypen und Paratypen Bagnalls aus der Sammlung des British Museums und schliesslich meine eigene Sammlung. Dank schulde ich daher speziell meinen Freunden H. H. Karny und D. Moulton; Dr. Dammerman (Buitenzorg) überliess mir das malayische Material, Dr. Bischoff vom Berliner Museum stellte mir die Type des *Taeniothrips distalis* Ka. zur Verfügung, und die Bagnallschen Typen gesehen zu haben, verdanke ich Sir Guy A. K. Marshall und Dr. F. Laing; schliesslich danke ich den Herren Dr. T. V. Ramakrishna Ayyar (Coimbatore) und Dr. R. Takahashi (Taihoku) für sehr wertvolles Material aus dieser Gattung.

Die Hauptschwierigkeit bestand in der Entlarvung der *Taeniothrips*-Arten der Gruppe des *nigricornis* Schm. (*longistylus* Ka.); in der Erkenntnis der Formen dieser Gruppe stecken wir noch in den Anfängen, solange bis nicht wenigstens von den bisher unterscheidbaren Arten alle ♂♂ bekannt sind. Es zeigt sich nämlich, dass die ♀♀ einander sehr ähnlich sind, während die ♂♂, wie es sich aus den bisher bekannten Formen ergibt, durch gewisse sekundäre Merkmale sehr leicht zu unterscheiden sind. Diese Gruppe sei zuerst und gesondert behandelt, und ich möchte hiezu speziell erwähnen, dass sie durch die allgemeine Körperform, die Beborstung des Kopfes und der Flügel, den kräftigen Sinneskegel des 6. Fühlergliedes und die auf ganz kleinen Höckerchen sitzenden Endborsten der Vordertibien, den unterbrochenen Kamm am 8. Tergit, den Mangel der Drüsenfelder der ♂♂ und andere, speziell die Micro-Setae betreffende Merkmale charakterisiert ist und hierdurch sich der Gattung *Odontothrips* sehr nähert; ich habe es aber vermieden, diese Arten mit den t i b i e n z a h n l o s e n *Odontothrips*-arten zu vereinigen, da die Larven keine Abdominalzahnreihen besitzen, und da auch der Sinneskegel am 6. Glied noch lange nicht so breit ist, wie bei allen *Odontothrips*-Arten. Die Artengruppe sei vorläufig als „Gruppe des *nigricornis*" bezeichnet. Im folgenden die einzelnen Arten, soweit sie neu sind oder

einer Neucharakterisierung bedurften. Die ersten sechs gehören zur *nigricornis*-Gruppe.

Taeniothrips nigricornis (SCHMUTZ).

1913. *Frankliniella nigricornis* SCHMUTZ, Sitzgsb. Akad. Wiss. Wien, CXXII (Juli), p. 1020.
1913. *Frankliniella obscuricornis* SCHMUTZ, l.c. p. 1022.
1913. *Physothrips usitatus* BAGNALL, Ann. Mag. Nat. Hist. (8), XII (Septemb.), p. 293.
1923. *Taeniothrips longistylus* KARNY, (♀), Journ. Siam Soc. XVI/2, p. 99, fig. 2.
1922. *Taeniothrips longistylus* KARNY, in DAMMERMAN, Treubia, III, p. 110.

Untersucht wurden von BAGNALL determinierte Exemplare des *Physothrips usitatus* und Typen der *Frankliniella nigricornis* (Exemplare von *Erythrina;* UZEL No. 61) [1]) und *obscuricornis;* KARNYS *Taen. longistylus* ist mit beiden identisch, doch bezieht sich die Beschreibung des Männchens (KARNY, l.c. p. 102) nicht auf diese Art, sondern auf *Taeniothrips formosae* MOULT., der zusammen mit *nigricornis* auf *Canavallia* lebt.

Das ♂ ist also noch nicht beschrieben worden; es ist von dem der verwandten Arten durch seine zartere Körperform und die hellere Färbung leicht zu trennen, ausserdem sind die Sternite glatt und haben keinerlei Auszeichnung.

Bei lichten Stücken sind Prothorax und Beine gelb, nur die Mittel- und Hintertibien aussen und bisweilen die Schenkel aussen leicht getrübt, der Thorax orange mit leichten grauen Trübungen, der Kopf und das Abdomen, dieses besonders gegen das Ende, bräunlich; Fühler grau bis graubraun, das 3. Glied mehr weniger hellgrau, die Flügel wie beim ♀, die weisse Präapikalbinde breit; bei dunklen Stücken ist der Kopf und das Abdomen braun, das 10. Segment lichter, der Thorax orange oder orange-bräunlich, alle Schenkel und Tibien am Aussenrande (oder mehr) oder ringartig leicht getrübt, die vorderen lichter.

Kopf bei ungepressten Stücken nach hinten etwas verengt oder mit geraden Seiten, die Fühler bei kleineren Exemplaren (wie sie mir von *Cyrtandra sulcata* und *Canavallia* vorliegen) 250, bei grossen (von *Cajanus indicus*) 320 μ lang; Glieder bei kleinen Stücken vom 3. an: 45 (18), 45 (17), 31 (14), 43 (16), 11 - 13 (8), 17 (6) oder bei grossen: 57 (19), 62 (19), 39 (15), 55 (17), 20 (6) μ; Hinterecken-Borsten des Prothorax 44 - 64 μ, am Hinterrande, innen, 3 - 4 Paar kleine Börstchen. Hauptader der Vorderflügel mit 11 - 12 + 2 Borsten. Abdominal-Sternite glatt, ohne Drüsenfelder und ohne accessorische Borsten oder Stacheln; am 9. Tergit befinden sich vor dem Hinterrande, zu beiden Seiten der Mitte: 1 Paar sehr kleiner Börstchen (etwa 20 - 25 μ von einander abstehend), dann folgt nach aussen, ganz nahe, ein kleiner Microporus, ausserhalb desselben wieder, etwas höher gelegen, eine mässig lange (36 - 42 μ), feine Borste, ausserhalb dieser, eine Dornborste, die aber sehr schwach entwickelt ist, und in der Länge (24 - 28 μ) und Stärke etwas variiert; auf diese folgt nach aussen eine sehr lange (112 - 140 μ), dunkle Borste; am Aussenrand, etwas höher, eine

[1]) Weitere in der Sammlung UZEL befindliche Exemplare, von SCHMUTZ als *Fr. nigricornis* bezeichnet, tragen die Etikette: „Auf Gras"; diese sind mit *Taeniothrips distalis* KA. identisch.

ebensolche, die aber etwas kürzer ist, 88 - 100 μ (nur bei grossen Stücken 108 μ) misst.

Die Extreme in den Körpermaszen sehen wie verschiedene Arten aus, sie erscheinen mir jedoch nicht scharf getrennt; ausserdem besteht in den sekundären Geschlechtsmerkmalen kein Unterschied zwischen den kleinen, lichteren und den grossen, dunkleren Stücken, nur dass bei letzteren das Dornpaar am 9. Tergit stärker entwickelt ist als bei den kleineren, wo es mehr borstenartig aussieht.

Taeniothrips nigricornis ist sehr häufig, besonders in den Blüten von Leguminosen; Neue Fundorte:

Java: Buitenzorg, 6.VIII.1920, in Blüten von *Phaseolus caracala* L. (leg. W. DOCTERS VAN LEEUWEN); Buitenzorg, III.1921, in Blüten von *Tephrosia* (leg. W. C. VAN HEURN); Buitenzorg, 15.VI.1922, an *Erythrina crista-galli* (leg. CAMMERLOHER); Buitenzorg, VI.1922, in Blüten von *Canavallia ensiformis* (leg. SMITH); Oengaran-Gipfel, ± 2000 m, 19.X.1913, in Blüten von *Impatiens platypetala* (leg. DOCTERS VAN LEEUWEN); Moeria-Gebirge, ± 300 m, 14.X.1912, an *Vigna catjang* WALL. (leg. DOCTERS VAN LEEUWEN); Semarang, 14.III.1912, in Blüten von *Uraria carinata* DESV., und 5.IX.1912, in Blüten von *Crotalaria saltiana* ANDT. (leg. DOCTERS VAN LEEUWEN); Tengger, ± 1800 m, 11.X.1920, aus Lupinen (leg. DOCTERS VAN LEEUWEN).

Verlaten Eiland: In Blüten v. *Vigna marina* MERR. und *Canavallia lineata,* 26.IV.1921, (leg. W. DOCTERS VAN LEEUWEN).

Sebesi: 28.IV.1921, in Blüten von *Vigna* spec. (5359), 25.I.1922, in Blüten von *Wedelia biflora* DC. (leg. DOCTERS VAN LEEUWEN).

Krakatau: Am Strande, 22-23.I.1922, in Blüten von *Vigna marina* MERR. und *Desmodium umbellatum* DC.; ± 400 m, in Blüten von *Cyrtandra sulcata* BL. 19.I.1922, am Strande in Blüten von *Canavallia lineata* DC. (leg. DOCTERS VAN LEEUWEN).

Sumatra: Medan, V.1922, in Blüten von *Impatiens balsamina;* ibidem, 26.8.1922, in Blüten von *Desmodium polycarpum* und in Blüten und Hülsen von *Phaseolus lunatus;* 8.XII.1922, in Blüten von *Crotalaria striata* (leg. L. FULMEK).

Formosa: Taihoku, 7.III.1921, an *Phaseolus vulgaris,* und 8.VI.1921, an *Arachis hypogaea* (leg. T. OKUNI).

China: Ca-Na, 26.X.1920, in Blüten von *Canavallia ensiformis,* und Sha-Tin, 10.XI.1920, in Blüten von *Crotalaria saltiana* ANDT. (leg. DOCTERS VAN LEEUWEN, No. 73 bezw. No. 89).

India: Coimbatore, in Blüten von *Cajanus indicus* und an Luzerne (leg. RAM. AYYAR, No. V bezw. No. 24); Taliparamba-Malabar, in Blüten von *Vigna catjang* (leg. RAM. AYYAR, No. XXII).

Taeniothrips distalis KARNY.

1913. *Taeniothrips distalis* KARNY, Archiv f. Naturgeschichte, p. 122.
1916. *Taeniothrips brunneicornis* BAGNALL, Ann. Mag. Nat. Hist. (8), XVII, p. 218.

1918. *Taeniothrips brunneicornis* BAGNALL, Ann. Mag. Nat. Hist. (9), I, p. 206.
1936. *Taeniothrips distalis* TAKAHASHI, Philippine Journ. Sci., 60, 4. (p.p.).
1937. *Taeniothrips distalis* TAKAHASHI, Tenthredo, I, 3, p. 348. (p.p.).

Es sei gleich hier erwähnt, dass TAKAHASHIS *T. distalis* ein Gemenge verschiedener Arten, wenigstens von *distalis, nigricornis* und *morosus* ist.

Die im Berliner Museum befindliche Holotype — von Dr. BISCHOFF gütigst übermittelt — ist leider völlig verschrumpft und verblasst, die Fühler sind verlorengegangen. Man muss daher auf KARNY's Beschreibung zurückgreifen und ich kann sie nur durch folgende Angaben ergänzen:

♀: In der Flügelfärbung ist noch zu erkennen, dass die Aufhellung vor dem Ende schmal ist, der dunkle Spitzenteil überragt die erste Distalborste deutlich; Vorderschenkel ganz dunkel.

Kopflänge 128 - 132, Breite an den Augen 192 μ; laterale Augenlänge 80 - 82 μ; innerer Abstand der (abgebrochenen) Interocellar-Borsten 20 μ; innerer Abstand der hinteren Ocellen 36 μ; Pronotumlänge 196 μ, Breite (etwas gedrückt) 255 μ; äussere Hinterecken-Borsten 80 - 86, innere vielleicht 92 - 95 μ; innerhalb derselben vier Paar Börstchen, das innerste 35 μ lang; basale Metathorax-Borsten abgestossen, ihr Abstand 36 μ; Länge der seitlich davon stehenden, kleineren Borsten 40 μ; Abstand der mittleren Poren 12 μ; Hinterschienen innen mit 7 Dörnchen (ausser den Endsporen). Flügellänge 1.14 mm; Costa mit 31 - 32, Hauptader mit 17 basalen und 2 distalen Borsten, Nebenader mit 17 - 18 Borsten. Poren und Dorsalborsten am 8. Tergit in einer Ebene, der Porus liegt ganz nahe der B.1, etwas ausserhalb derselben; Borsten am 9. Segment, B.2: 192, B.3: 180 μ; B.1 am 10. Segment 192, B.2: 172 μ; Länge der Hintertibien 292 μ.

Fundort: Okayama, 4.VI.1904, H. SAUTER, S.V.-620.

Von *Taeniothrips brunneicornis* BAGNALL, den ich mit *distalis* für identisch halte, sah ich ein Exemplar mit der Etikette: Japan, Ashyu, 21.5.1915, coll. J. E. A. LEWIS.-Reg. 136; Brit. Mus. 1928 - 292.

Die Flügelaufhellung vor der Spitze ist so wie bei *distalis*, die Costa bleibt auch hier dunkel, die Fühler sind wie bei diesem ganz dunkel, die Glieder 3 - 6 messen: 80, 80 - 82, 48 - 50, 70 μ; Hintereckenborsten 76 - 80 μ; Abstand der Interocellarborsten 22 μ; Kopfbreite 182. Flügellänge 1.09 - 1.12 mm; Hauptader mit 19 - 21 basalen und 2 (auf der einen Seite ausnahmsweise 3) distalen Borsten, Nebenader mit 18 Borsten; Hintertibien innen mit 8 - 9 Börstchen. B.3 des 9. Segmentes 176 (die anderen abgebrochen), B.1 des 10. Segmentes 196, B.2 184 μ.

Weitere sichere Fundangaben: Formosa, Taihoku, 5.IV.1934 und Taichu-Shu, 12.VIII.1934 (leg. TAKAHASHI). — Java: Merbaboe Gebirge, ± 1500 m, 28.XII.1912, in Blüten von *Cinchona hedgeria* (1 ♀, leg. DOCTERS VAN LEEUWEN); Tengger, 11.X.1920, ± 1800 m, aus Lupinen (1 ♀, leg. DOCTERS VAN LEEUWEN). — China, Hangchow, 9.V.1937, in *Iris* spec. (leg. H. C. YAO, No. 130).

Taeniothrips distalis var. **infernalis** nov.

Diese Form, wiewohl dem *distalis* typ., äusserst ähnlich, kann unmöglich mit ihn konfundiert werden, da die Flügel vor der Spitze keine Spur einer Auf-

hellung zeigen, es sich also zum mindesten um eine ganz auffallende Variation handeln muss, möglicherweise aber um eine besondere Art, die erst wenn mehr Material — speziell das Männchen — vorliegt, genauer charakterisiert werden kann.

♀: Ganz dunkel, schwarzbraun, alle Schenkel und Tibien schwärzlich, nur die Vordertibien längs der Mitte etwas aufgehellt (nicht hellgelb), alle Tarsen gelbgrau; Vorderflügel an der Basis und Schuppe getrübt, dann — mit Ausnahme des Vorderrandes bis zur Hauptader, der getrübt ist — hyalin, vom Beginne der Nebenader an aber wieder der ganzen Breite nach bis zur Spitze stark graubraun getrübt; Borsten am Körper schwärzlich, ebenso die Dörnchen an den Hintertibien. Die ganzen Fühler dunkel.

Kopf von den Augen an 168, total 188 μ lang, an den Augen 196 μ breit; laterale Augenlänge 84 - 88, dorsale 107 μ; Wangen nach hinten verengt, Interocellarborsten lang, ihr Abstand etwa 35 μ; Fühlerlänge 389 - 398 μ, Glieder vom 3. an: 76 - 80 (28), 76 (26), 52 (18), 74 (20 - 21), 19 - 20 (8), 24 (6) μ; das 3. und 4. Glied am Ende kurz halsförmig geschnürt, Gabeltrichome am 3. und 4. Glied 56 - 64 μ lang, der dicke, kleine Sinneskegel am 5. Glied 14 μ, der des 6. Gliedes kräftig; Stylus sehr schlank; Borsten auf den Fühlern ganz dunkel. Pronotum (ungepresst) 190 μ lang, 237 μ breit; Hintereckenborsten mässig lang, 78 - 88 μ, die innerste der vier Paare Hinterrandborsten etwa 36 μ; Pterothoraxbreite 330 μ; Flügel 1.003 mm lang, Costa mit etwa 30, Hauptader mit 4 + 12 oder 4 + 14 basalen und 2 distalen, Nebenader mit 16 Borsten. Hintertibien innen mit wenigstens 8 Dörnchen (ausser den Endspornen). 8. Tergit wie bei *distalis,* Sternite ohne accessorische Borsten. B.2 am 9. Segment mindestens 188 μ lang, B.3: 188 - 192 μ; B.2 am 10. Segment 180 μ. Legebohrer 346 - 355 μ.

♂ unbekannt.

Fundort: S u m a t r a, Sibajak, 1212 m, VIII.1923 (leg. L. Fulmek).

Taeniothrips peculiaris (Bagnall).

1918. *Physothrips peculiaris* Bagnall, Ann. Mag. Nat. Hist. (9), I, p. 206 (♂).
1928. *Taeniothrips pingala* Ramakrishna Ayyar, Mem. Dept. Agr. Ind., IX, no. 7, p. 260.

Es ist nur das Männchen bekannt und es ist möglich, dass es sich um das Männchen des *distalis* oder einer nahe verwandten Art handelt.

T. peculiaris Bgn. (Typen gesehen) ist identisch mit *T. pingala* Ram. (Typen gesehen); das mir vorliegende Präparat — ich verdanke es Ramakrishna Ayyar selbst — enthält 3 ♂♂, (Bangalore, 22.IV.1926, No. 119), van denen eines nicht hierher, sondern zu *nigricornis* Schm. gehört.

In der Färbung ist *peculiaris* dem *nigricornis* ähnlich, in der Länge der Beine und dem Fühlermaszen aber dem *distalis* oder (da man ja bloss mit Männchen vergleichen soll) dem *morosus* n.sp. (s. unten), mit dem er auch den Besitz der Sternit-Bürste gemein hat. Diese Sternit-Beborstung haben Bagnall und Ramakrishna übersehen, offenbar, da die Exemplare sehr licht und auch diese Borsten ganz hell sind, und da man der Bauch-Beborstung überhaupt erst neuerdings Beachtung schenkte; diese bürstenartige Sternit-Beborstung ist sehr cha-

rakteristisch; sie besteht auf den mittleren Sterniten aus 6 - 7 ganz unregelmässigen Querreihen von Lanzett-Börstchen, die kürzer sind, und von der Segment-Fläche deutlicher abstehen, als bei *morosus;* die Hinterränder der Sternite tragen je 6 Haarborsten, nicht Lanzett-Borsten; Dorn am 9. Tergit wie bei *morosus,* etwa 32 μ lang, die lange Borste daneben ausserhalb 132 - 148 μ, die Lateralborste ist 120 μ lang.

Die BAGNALL'schen Typen (India, Pusa, 24.II.1906, an Lucerne, H. M. LEFROY; Brit. Mus. 473) haben, da ausgeblasst, eine viel lichtere Färbung als die RAMAKRISHNAS, aber in der Flügel-Beborstung finde ich — im Gegensatz zu RAMAKRISHNA — keinen Unterschied, weder auf Grund der Beschreibungen noch auf Grund der Originalexemplare.

Taeniothrips centrispinosus spec. nov.

♂: Von *peculiaris* und *morosus* durch die glatten, völlig einfachen Sternite, von allen Arten durch die charakteristische Bedornung des 9. Tergites völlig verschieden. Fühler sehr schlank, das 6. Glied dicker, sodass die Fühler etwas keulig aussehen.

Färbung des einzigen Stückes dunkel, braun, Thorax nicht deutlich lichter; Fühler ganz graubraun, das 3. Glied nicht gelb, aber doch etwas lichter als die anderen, und sowie das 4. an der Endschnürung weisslich. Flügel gebändert, wie bei *nigricornis* etc., nur die Endtrübung schmäler, sodass nur die apikale der beiden Distalborsten im dunklen Teil liegt. Borsten am Abdomen-Ende sehr kräftig und dunkel, an den Beinen alle Schenkel dunkel, Tibien gelblich, mögen aber bei dunkleren Stücken in der Mitte oder am Aussenrande leicht getrübt sein.

Kopflänge vom Vorderrand der Augen etwa 120 μ; Stellung der Kopfborsten wie bei den vorigen, Interocellarborsten lang, etwa 64 - 66 μ; Augen deutlich beborstet; Fühlergliederlängen (-breiten) vom 2. Gliede an: ?(27), 72 - 76 (15), 68 (16), 44 (16), 74 - 76 (20), 11 (8), 17 (5) μ; das 3. und 4. Glied am Ende kurz geschnürt, an den Seiten nicht gewölbt, eher eine Strecke weit etwas konkav, mit langen Mikrosetulae, der Sinneskegel des 6. Gliedes hinter der Mitte aus breiter Basis entspringend, spitzig, die Mitte des 7. Gliedes erreichend. Pronotum etwa 120 μ lang, die Hintereckenborsten 64 - 72 μ lang; innerhalb derselben 4 - 5 Paare Börstchen, deren innerstes 32 - 36 μ misst; innere Basalborsten des Metascutums etwa 52 μ lang; Flügellänge 709 - 727 μ; Hauptader mit 4 + 9 (7) basalen und 2 distalen Borsten, Nebenader mit 12 - 13 Borsten. Sternite kahl, ohne Drüsenfelder; 9. Tergit hinter der Mitte, doch weit vor dem Hinterrande, mit 1 dunklen Dornpaar, 32 - 34 μ lang, Abstand der Dorn-Poren 10 μ; seitlich davon (etwas höher) ein 92 μ langes Borsten-Paar, ausserhalb (etwa in der Höhe der Mitteldornen) eine 24 - 26 μ lange Dornborste, hinter dieser steht eine starke Hinterecken-Borste (Spitze abgebrochen), Lateralborsten sehr kräftig, deren Länge 116 - 120, deren Dicke 4 μ; zwei dicke, laterale Borstenpaare des 10. Segmentes — eine oben, eine unten — etwa 125 μ lang.

Fundort: Java, Buitenzorg, 10.XI.1921, leg. W. DOCTERS VAN LEEUWEN, mit der Bemerkung: „im Freien gefangen".

Taeniothrips mucunae spec. nov.

Von dieser Art ist nur das ♀ bekannt. Es ist dem des *morosus* äusserst ähnlich, durch die längeren, dünneren Fühler, die absolut und relativ längeren Sinneskegel derselben, von *distalis* ausserdem durch die wie bei *morosus* kürzeren Flügel spezifisch verschieden.

Körperfarbe dunkel, nur die Vordertibien gelblich, am Innen- und Aussenrand getrübt, die Hintertibien am Grunde oft, aber nicht immer, mit gelblichem Ring, alle Schenkel ganz dunkel; Flügel an der Basis hyalin — äusserste Basis und Schuppe wie gewöhnlich leicht getrübt —, übrigens stark getrübt, vor der Spitze mit einem breiten hyalinen Querband, das etwas breiter ist als die Spitzentrübung; Fühler ganz dunkel. Borsten dunkel.

Kopf im Verhältnis zum Prothorax etwas grösser als bei *morosus,* etwa 180 μ breit, von den Augen an 156 μ lang (samt IAF 178 - 181); Augenlänge 88, dorsal 104 μ; Kopfborsten ohne Besonderheit, wie für die Gruppe charakteristisch: 1 Paar einander nahe stehende Anteocellar-Borsten in der Mitte zwischen der Fühlerbasis und dem 1. Ocellus; 1 Paar sehr lange (88 μ) Interocellar-Borsten hinter dem vorderen Ocellus, aber noch ganz wenig vor dem Niveau des Vorderrandes der beiden hinteren Ocellen; die innerste Postokularborste ist vom hinteren Ocellus etwa 10 μ entfernt; Maxillarpalpen 38, 18, 28 μ; Fühler 424 - 433 μ lang; Gliederlängen (-breiten): 36 (39), 48 - 50 (31), 84 (27), 88 (25), 56 - 60 (17 - 19), 76 (20), 19 - 20 (6 - 9), 24 (4 - 6) μ; das 3. und 4. Glied am Ende halsförmig geschnürt, beide deutlicher vasenförmig als bei *morosus,* der Innenrand der Gabeltrichome (bei der Holotype) vom Gliedende des 3. Gliedes etwa 17 μ, am 4. Glied 22 μ entfernt; Sinneskegel am 3. Glied 80 - 82 μ, am 4. Glied 70 - 76 μ lang, also bedeutend länger als bei *morosus* (am 3. Gl. 48 - 60, am 4. Gl. 48 - 56 μ) oder bei *distalis* (*brunneicornis*) (am 3. und 4. Gl. 52 - 56 μ); das 5. Glied ist viel schlanker als bei den genannten Arten, etwa 3.2 - 3.5 mal so lang als breit (bei *distalis* und *morosus* höchstens etwa 2.5 - 2.6 mal so lang als breit); der längere Sinneskegel des 6. Gliedes reicht etwa zur Mitte des folgenden Gliedes, der haarartige Sinneskegel des 7. Gliedes erreicht die Spitze des 8. Pronotum 187 - 194 μ lang, 225 - 242 μ breit, die nach vorn gerichtete Vordereckenborste etwa 36 μ lang, Scheibe spärlich beborstet, Hinterecken-Borsten 84 - 96 μ lang, innerhalb derselben 4 Paar innere Hinterrandborsten, die innerste etwa 36 μ lang. Vordertibien wie bei den Verwandten. Pterothoraxbreite 345 μ; das innere Basalborsten-Paar des Metascutums am Vorderrand gelegen, etwa 80 - 85 μ lang; Flügellänge 0.899 - 1.02 mm, viel kürzer als bei *distalis,* etwa so lang wie bei *morosus;* die Aufhellung vor der Spitze ist hyalin, etwa wie bei *nigricornis;* Costa mit 27 - 29, Hauptader mit 4 + 11 bis 4 + 14 basalen und 2 distalen, Nebenader mit 16 - 18 Borsten. Poren am 1. Tergit vom Hinterrande nur 10 - 16 μ entfernt (bei *distalis* weiter abstehend), von einander 40 μ abgerückt, einander näher als es die Microsetae sind; 2. Tergit an den Seiten mit 3 Borsten; Sternite ohne accessorische Borsten; Hintertibien 267 - 270 μ lang, ausser den Enddornen mit 6 - 8 Innenrand-Börstchen; Porus am 8. Tergit in der Höhe und ganz nahe der Innenborste (B. 1), Kamm am Hinter-

rande in der Mitte breit unterbrochen; Borsten am 9. Tergit, dorsale 56, Hinterrand-Borsten B. 1: 188, B. 2: 200 - 205, B. 3: 184 - 200 μ; B. 1 des 10. Segmentes 184 - 208, B. 2: 180 - 188 μ lang; 10. Segment oben bis zur Borsten-Basis gespalten; Legebohrer 337 μ lang.

Fundort: J a v a, Buitenzorg, 27.VI.1922, in *Mucuna*-Blüten (leg. CAMMERLOHER).

L a r v e.

II. Stadium: Die Larven sind von denen des *morosus* leicht zu unterscheiden: Sie haben zwar einen deutlichen (oben lockeren, unten dichten) Kamm am 9. Segment-Hinterrand, doch ist das 9. wie das 10. Segment weniger stark chitinisiert, hell, vom übrigen Körper in der Färbung wenig verschieden; auch ist am Hinterrande des 8. Sternites keine Höckerchen-Struktur zu erkennen, während diese bei *morosus* sehr deutlich ist.

Taeniothrips morosus spec. nov.

♀: Ausgefärbte Stücke schwarzbraun bis schwärzlich, unreife Exemplare können am ganzen Körper, mit Ausnahme des graubraunen Kopfes und Abdomenendes, orange sein, mit heller Abdomenbasis; alle Schenkel dunkel, Mittel- und Hinterschienen dunkel, Vorderschienen gelblich, aussen und innen mehr weniger stark grau getrübt; Flügel etwa wie bei *mucunae,* an Basis und Schuppe leicht getrübt, dann mit einem breiten hyalinen Band, in der Mitte breit, an der äussersten Spitze schmal getrübt, vor der Spitzentrübung mit einem fast oder ganz hyalinen Querband; die erste Distalborste der Hauptader liegt gewöhnlich an der Grenze der Spitzentrübung, oder noch im hyalinen Teil; obwohl das 3. Glied der Fühler ganz wenig lichter ist als das 4., sind die ganzen Fühler grau getrübt, bei ganz dunklen Stücken ganz grauschwarz. Borsten am Körper dunkel.

Körper etwa wie bei *distalis* und *mucunae,* doch sind die Fühler deutlich weniger schlank als bei letzterem, während das präapikale Band der Vorderflügel breiter und heller ist als bei *distalis* und die Flügel viel kürzer sind als bei diesem.

Kopf (der Holotype) 156 (total 172) μ lang, an den Augen 180 - 184 μ breit; Augenlänge (lateral) 80-(dorsal) 92 μ; Kopfborsten wie bei *mucunae,* Interocellarborsten 72 - 76 μ lang, in oder ganz wenig vor der Höhe des Vorderrandes der hinteren Ocellen; die innerste kleine Postokularborste ist vom hinteren Ocellus 8 - 10 μ entfernt; Maxillarpalpen glieder 28 - 30, 18 und 24 μ lang; Fühlerlänge 363 -380 μ; Gliederlängen (-breiten): 28 - 32 (12), 44 - 46 (31), 72 - 76 (28 - 29), 72 - 76 (26 - 28), 46 - 48 (18 - 20), 66 - 70 (20), 16 - 18 (9 - 10), 22 - 24 (6 - 7) μ; das 3. und 4. Glied am Ende nur kurz-halsförmig, der Innenrand der Gabeltrichome vom Glied) Ende am 3. Glied nur 12 μ, am 4. Glied 16 - 18 μ entfernt; Sinnes-Trichome des 3. Gliedes 56 - 58, des 4. Gliedes 54 - 56 μ lang; das 5. Glied weniger schlank als bei *mucunae;* der längere, an der Basis dicke Sinneskegel des 6. Gliedes erreicht ganz oder fast die Mitte des 7., der kurze

(äussere) Sinneskegel am 5. Glied ist dicker und kürzer als bei *mucunae*, der haarartige Kegel des 7. Gliedes erreicht fast die Spitze des 8. Gliedes. Pronotum 180 - 200 μ lang, 225 - 242 μ breit; die nach vorn gerichtete, kleine Vorderecken-borste misst 34 - 36 μ, Scheibe spärlich beborstet, Hinterecken-Borsten 68 - 80 μ lang, die innerste der 4 Paar inneren Hinterrandborsten ist 28 - 30 μ lang. Pterothoraxbreite 328 - 363 μ; Basalborsten des Metascutum wie bei *mucunae;* Flügel viel kürzer als bei *distalis*, 787 - 980 μ lang, die Aufhellung vor der Spitze breiter und lichter, wie bei *mucunae;* Costa mit 27 - 30, Hauptader mit 4 + 11 bis 4 + 14 basalen und 2 distalen Borsten, Nebenader mit 13 - 16 Borsten; Microporen am 1. Tergit vom Hinterrande 8 - 12 μ, etwa so weit wie von den Microsetae, entfernt, von einander 44 - 60 μ abstehend, so weit oder weiter entfernt als die Microsetae es sind; Lateralborsten des 2. Tergites wie bei *mucunae;* Sternite ohne accessorische Borsten; Hintertibien 232 - 260 μ lang, ausser den Endsporen mit 5 - 7 Innenrand-Dörnchen; Poren, Setae und Kamm des 8. Tergites wie bei *mucunae;* Borsten am 9. Segment, B. 1: 148 - 174, B. 2: 180 - 196, B. 3: 160 - 172 μ; Borsten 1 am 10. Segment 184 - 192, B. 2: 168 - 180 μ lang; Legebohrer 328 μ.

♂: Mehr oder weniger licht braun oder gelblich-graubraun, der Kopf und das Abdomenende (9. Sgm.) immer etwas dunkler; Scheitel-Hinterrandsaum schwärzlich; Thorax meist mit etwas orange (die roten Flecke in den Beinen der Allotype sind Pilzrasen); Ocellen rötlich; Schenkel graubräunlich, an der Basis und Spitze lichter oder hell gelb; Schienen licht, mit dunklerem Ring in der Mitte, oder an den Rändern dunkel; Fühler dunkel, das 3. Glied hellgrau, auch das 4. und 5. heller grau als die übrigen, das 4. und 5. mit hellem Subbasalring. Flügel wie beim Weibchen, das präapikale, hyaline Querband aber noch breiter.

Kopf von den Augen an 124, total 132 - 136 μ lang, an den Augen 160 μ breit; Augenlänge lateral 72, dorsal 80 μ; Interocellarborsten 64 - 68 μ; bisweilen zwischen den hinteren Ocellen gelegen; hinter den Augen ein kleiner, einspringender Winkel, eine laterale Postokularborste misst 24 - 28 μ; die Schläfen selbst ganz unmerklich konkav; Kopf im hinteren Abschnitt deutlicher gerunzelt als dort, wo die postokulare Querreihe steht; Fühler sehr schlank, Gliedermasze vom 3. an: 72 (18), 68 (18), 44 - 46 (16 - 17), 58 - 60 (17 - 18), 14 (9), 18 (6) μ; das 3. Glied an den Seiten fast etwas konkav, am Ende wie das 4. kurz halsförmig geschnürt, Länge der Sinneskegel am 3. und 4. Glied 28 - 31 μ; Prothorax 198 - 208 μ breit, Hinterecken-Borsten 56 - 68 μ lang, innerste der 4 Posteromarginalborsten 36 - 40 μ; Flügellänge 727 - 780 μ; Hauptader mit 4 (3) + 9 oder 4 + 8 Borsten an der Basis und 2 Distalborsten, Nebenader mit 13 - 17 Borsten. — Die Abdominal-Sternite 2 - 8 mit zahlreichen accessorischen, getrübten Lanzett-Borsten, die fast anliegen und in 2 - 4 unregelmässigen Querreihen angeordnet sind; Drüsenfelder fehlen wie bei den anderen Verwandten; auch die 6 Hinterrand-Borsten der Sternite sind wenigstens auf den vorderen und mittleren Segmentes deutlich lanzettförmig gestaltet, was bei *peculiaris* nicht der Fall ist; die Länge dieser Lanzettborsten variiert etwas, die meisten sind

28 - 32 μ lang; am 9. Tergit stehen am Hinterrande, nahe der Mitte, 2 Microsetae, seitlich davon jederseits eine feine, etwa 48 - 50 μ lange Borste, dann ein etwa 36 μ langer Dorn, der seitlich von einer etwa 132 μ langen stärkeren Borste begleitet ist (Dorn und Borste sind an der Basis 3 - 4 μ dick); ausserhalb, etwas höher, steht wieder eine feine (48 - 52 μ) und eine lange (104 - 108 μ), dicke Borste. Penis, seitlich gesehen, am Ende nicht verdickt.

Diese Art ist in beiden Geschlechtern in grosser Serie vorhanden, und zufolge einiger Variabilität von KARNY sowohl wie von mir mit *distalis* bisher konfundiert worden; sowohl das Material von *Desmodium polycarpum* als das von *Desmodium gyroides* zeigt dasselbe Männchen mit den oben beschriebenen Weibchen assoziiert, sodass mit Sicherheit angenommen werden kann, dass die beiden Geschlechter zusammengehören. Wenn einmal über das ♂ von *distalis* Sicherheit herrscht, wird es nicht schwer sein, die spezifische Verschiedenheit von *morosus* and *distalis* besser zu erkennen. — Die Art ist häufiger als *distalis*.

Fundorte: Sumatra, Medan, 26.VIII.1922 und 31.X.1922, in Blüten von *Desmodium gyroides*, bezw. *Desmodium polycarpum* (leg. L. FULMEK; Typenmaterial einschliesslich ♂-Allotype); Prapat-Toba-See, 4.VI.1922, in Blüten von *Tephrosia candida* (leg. L. FULMEK; Typenmaterial einschliesslich ♀-Holotype); Medan, Siantar, 17.VII.1921, 1 ♀, im Auto gefangen (leg. W. DOCTERS VAN LEEUWEN).

Java: Buitenzorg, III.1921, in Blüten von *Tephrosia* (leg. VAN HEURN); ibidem, VI.1922, in Blüten von *Canavallia ensiformis* (leg. SMITH); ibidem, 8.II.1923, in Blüten von *Canavallia ensiformis* (leg. CAMMERLOHER); Tengger, ± 1800 m, 11.X.1920, aus Lupinen (J. DOCTERS VAN LEEUWEN).

Krakatau: Am Strande, 22.I.1922, in Blüten von *Desmodium umbellatum* (leg. DOCTERS VAN LEEUWEN).

India: Coimbatore, 15.II.1924, *Dolichos lablab* (RAMAKRISHNA AYYAR No. 41).

Taeniothrips lagoenifer spec. nov.

♀: Kastanienbraun mit reichlich roter Pigmentierung, Fühler dunkel, nur die Hälse der Glieder 3 und 4 aufgehellt bis grau-gelblich; das 1. und 2. Glied am dunkelsten, 5. - 8. Glied mehr weniger hellgrau; Mittel- und Hinterschenkel dunkel oder wenigstens leicht getrübt, die Tibien ziemlich licht und nur ganz schwach getrübt, an den Vorderbeinen sind die Tibien am Aussenrande aber deutlich dunkler als die Schenkel, welche fast ganz hellgelb sind; alle Tarsen hellgelb; Flügel der ganzen Länge nach völlig gleichmässig getrübt, nur mit kleiner, heller Subbasal-areola.

Kopf lang mit stark vorgequollenen Augen, die grob facettiert und behaart sind und 104 - 110 μ messen; Kopf hinter den Augen stark geschnürt, die Wangen selbst nach hinten erweitert, jedoch wenig gewölbt; Kopf vorn wie bei Megalurothrips in einen kurzen Fortsatz ausgezogen, auf dem die Fühler sitzen (Abstand der Kopfspitze vom Augen-Vorderrand 36 μ); die vorderen Stirnborsten stehen nicht in einer Querreihe sondern an den Ecken eines Tra-

pezes; Interocellarborsten lang, gut 96 μ, dunkel, in der Höhe des Vorderrandes der hinteren Ocellen, einander sehr genähert; postoculare Reihe sehr deutlich, ohne Besonderheit; Scheitel mit verhältnismässig engen Querrunzeln. Fühler etwa 500 μ lang, sehr charakteristisch gebaut; das 3. Glied am Ende etwas halsartig verengt, aber nicht lang-ausgezogen, mit ungewöhnlich langen Gabeltrichomen (120 - 145 μ), das 4. Glied u n g e w ö h n l i c h lang-flaschenhalsartig ausgezogen, gleichfalls mit sehr langen (136 - 140 μ) Gabeltrichomen, die das Ende des 5. Gliedes erreichen; der Abstand des Innenrandes der Gabeltrichome vom 4. Glied beträgt 52 - 60 μ; das 5. Glied ist schmal, wie das 4. mit hellem Subbasalring, das 6. mit dem einen (der drei) Sinneskegel vor der Mitte, der die Mitte des 7. Gliedes erreicht, ein 2. Kegel im letzten Drittel erreicht die Mitte des 8. Gliedes, ein ganz kurzer Kegel knapp vor der Mitte des 6. Gliedes; die beiden Stylusglieder ungefähr gleichlang. Fühlergliederlängen (-breiten): 28 - 32 (42), 52 - 56 (32), 84 (31), 128 (28), 62 (16), 88 (17), 20 - 21 (10), 20 - 22 (8) μ; dünnste Stelle am Halse des 4. Gliedes 8 μ, Endbreite 13 μ. Mundkegel schlank, Maxillarpalpen sehr schlank, ihre Glieder 32 (7), 12 (6), 28 (3) lang (breit). Pronotum 157 μ lang, 260 μ breit, Scheibe reichlich mit zum Grossteil nach hinten gerichteten Börstchen besetzt, Hintereckenborsten kräftig, s t u m p f, etwa 120 - 130 μ lang; innerhalb der Eckenborsten stehen nur z w e i Paar Börstchen. Beine sehr schlank, Hintertibien mit 9 - 11 gelben Innenrand-Stachelchen, Tibienlänge 280 μ. Pterothoraxbreite 380 μ, Länge 415 μ; Flügel 1.176 - 1.194 mm lang, Costa mit 25 - 28, Hauptader mit 3 (4) + 4 (5) basalen und 1 (2) + 2 distalen Borsten, Nebenader mit 12 - 13 Borsten. Abdomen langborstig, o h n e accessorische Borsten der Sternite, mit langem, dichten Kamm am 8. Tergit; Borsten am 9. Segment, dorsale 68 - 84, B. 1: 184 - 196, B. 2: 188 - 200 μ lang; 10. Segment oben höchstens bis zur Borstenbasis gespalten, B. 1, 2: 185 - 192 μ lang; 8. Segment mit einigen hakenartig gekrümmten Borsten, wie diese TRYBOM für *Cricothrips* angibt, die aber auch bei vielen anderen *Taeniothrips*-Arten vorkommen. Legebohrer 304 - 308 μ lang. — Gesamtkörperlänge (stark gedehnt): 1.81 - 1.97 mm.

Fundort: J a v a, Salak-Gebirge, ± 800 m, 26.X.1921, in Blüten von *Cyrtandra* (*?repens*), leg. DOCTERS VAN LEEUWEN.

Ich kenne zwei vollkommen übereinstimmende Exemplare dieser interessanten Species, die durch die Form des 4. Fühlergliedes leicht zu charakterisieren ist; sie ist sicherlich der Art *T. mischocarpi* (ZIMMERM.), die mir unbekannt blieb, sehr ähnlich, diese nähert sich aber in der Bildung des 4. Fühlergliedes mehr der folgenden Art.

Taeniothrips cyrtandrae spec. nov.

1922. *Cricothrips* n. sp. KARNY, in DAMMERMAN, Fauna Krakatau, etc., Treubia, III, p. 110.

Eine etwas kleinere Art, mit oft ganz hellgelben Beinen, viel kürzerem 4. Fühlergliede und kürzeren Borsten des Prothorax.

♀: Braun, mit reichlich roter Pigmentierung, Fühler dunkel, 3. Glied von

der Einlenkung der Trichome an weisslich, das 4. an derselben Stelle hellgrau aufgehellt; Borsten dunkel, Flügel gleichmässig stark getrübt, wie bei vorigem; Beine hellgelb, Hüften dunkel, bei stark ausgefärbten Stücken sind die Beine zum Teil schwach getrübt.

Kopf kürzer als bei *lagoenifer*, Form ähnlich, Wangen gewölbt, Länge 188 - 192 μ, der vorgezogene Teil 30 μ, Breite an den Augen 176, hinten 200 μ; Interocellarborsten etwa 80 μ lang, stumpf wie bei vorigem, einander sehr genähert (Innerer Abstand 10 μ); Anteocellarborsten gut entwickelt, spitzig, wie bei vorigem weit vor dem vorderen Ocellus; Kopf hinter den Augen geschnürt. Fühler 433 μ lang; Gliederlängen (-breiten) vom 3. an: 68 - 80 (31 - 32), 86 - 100 (25), 54 - 56 (15), 76 - 82 (17), 14 - 16 (11), 14 - 16 (8) μ; Sinneskegel am 3. und 4. Glied 76 - 80 μ lang, die letzteren erreichen nicht die Spitze des 5. Gliedes, sondern etwa die Mitte; 3. Glied dick, am Ende halsförmig geschnürt, aber nicht lang-ausgezogen, das 4. Glied am Ende halsförmig ausgezogen, aber bedeutend kürzer als bei vorigem; die 3 Sinneskegel am 6. Glied ähnlich wie bei *lagoenifer*. Pronotum 144 - 148 μ lang, 208 - 260 μ breit, Scheibe reichlich mit meist nach hinten gerichteten Börstchen versehen, Hinterrand mit nur zwei Paar inneren Börstchen, von denen das innerste 28 - 32 μ misst; Hintereckenborsten kürzer als bei lagoenifer, 96 und 88 μ, kräftig, dunkel, am Ende schräg abgestutzt wie bei vorigem; die längsten Borsten an der Basis des Metathorax etwa 80 μ lang; Pterothorax (Holotype) 355 μ breit und 363 μ lang. Hintertibien kürzer, 224 μ, abgesehen von den Endsporen mit etwa 8 gelblichen Dörnchen am Innenrand. Flügel breit, 830 - 970 μ lang, Costa mit 21 - 25, Hauptader mit 3 (4) + 6 (5) basalen und 1 + 2 distalen Borsten, Nebenader mit 11 - 14 Borsten. Abdominalsternite o h n e accessorische Borsten, 8. Tergit mit langem, dichtem, regelmässigem Kamm; Borsten am 9. Segment, dorsale 68, B. 1 der Hinterrandreihe 160 - 176, B. 2: 168 - 185, B. 3: 164 - 176 μ; B. 2 am 10. Segment 152 - 168, B. 1: 164 - 176 μ; 10. Segment oben nicht oder nur undeutlich gespalten. Legebohrer-Länge: 284 - 304 μ. — Gesamtkörperlänge (sehr stark gedehnt): 1.82 mm; (normal): 1.56 mm.

♂: Färbung wie beim ♀, auch die Beborstung der Flügel wie bei diesem. Fühler 363 μ lang: Gliederlängen: 24, 40, 58 - 60, 72 - 80, 46 - 50, 76 - 88, 6 - 7,12 μ; das 6. Glied länger als das 4.; Stylus sehr kurz, dick. Maxillarpalpen 3-gliedrig, das Endglied sehr dünn, das 2. kurz; Hinterecken-Borsten des Pronotums 92 und 80 μ; Sternite 3 - 7 mit grossen, quer-hantelförmigen Drüsenfeldern, das des 7. Sternites 88 - 92 μ breit, vorn nicht eingekerbt; 9. Tergit median mit 1 Paar 64 - 68 μ langen, dunklen Borsten, seitlich davon mit 1 kurzen (28 - 30 μ) Borstenpaar; innerhalb dieser Borsten mit 1 Paar borstenloser Poren und dahinter mit 1 Paar äusserst kleiner Börstchen; zwei Lateralborstenpaare desselben Segmentes 120 μ und 116 μ lang; Penis verhältnismässig kurz, stark gebogen. Sternite ohne accessorische Borsten. Flügellänge 727 - 778 μ. Nebenader mit 10 - 12 Borsten.

Fundort: K r a k a t a u, ± 800 m, 22.I.22, in Blüten von *Cyrtandra sulcata* BL. (leg. DOCTERS VAN LEEUWEN); S u m a t r a, Ostküste, Sibolangit, IX.1920, in

Blüten von *Didymocarpus horsfieldi* Ktge. (Docters van Leeuwen leg.); J a v a, Buitenzorg, in Blüten von *Gastrodia javanica,* 20.XI.1918 (Docters van Leeuwen leg.).

Bemerkung: Bei den Exemplaren von Sumatra sind die Fühler vom 3. Glied an: 84, 104 - 112, 64 - 66, 86, 17.5, 18 µ lang; die ♂♂ stimmen mit denen von der Insel Krakatau ganz überein; die Tiere sind stark ausgefärbt, daher sind die Vorderschienen und die Hinterschenkel etwas getrübt.

Taeniothrips cyrtandrae f. **amphorifer** nov.

Dem typischen *T. cyrtandrae* äusserst ähnlich, und m.E. nicht spezifisch verschieden, doch zeigen sich im männlichen Geschlecht verschiedene Abweichungen. Das ♂ ist grösser als das von *cyrtandrae* typ., mit viel längeren Fühlern. Ob dieses Merkmal genügen würde, die beiden Formen spezifisch zu trennen, kann nur weiteres Material klären.

♂: Fühler 433 - 440 µ lang; Gliederlängen (-breiten): 32 - 36 (34), 44 (29 - 31), 80 - 84 (24), 90 - 100 (22), 56 - 58 (15), 100 - 103 (15 - 16), 10 - 12 (8), 12 - 14 (7) µ; Sinneskegel am 4. Glied etwa 70 µ, erreichen die Mitte des folgenden Gliedes. Kopflänge 172, von den Augen ab 148 µ; Hintereckenborsten des Prothorax 100 - 104 µ und 92 - 96 µ; Sternite 3 - 7 mit grossen, quer-hantelförmigen Drüsenfeldern, deren Breiten bei der Type 102, 100, 92, 86 und 82 µ betragen, bei einer Paratype 112, 106, 104, 100 und 90 µ. Das Drüsenfeld des 7. Segmentes ist bei einem Expl. tief eingekerbt, bei dem anderen nicht. Dorsalborstenpaar am 9. Segment 76 - 84 µ lang, die Lateralborsten sind 155 und 172 µ lang. Flügellänge 796 - 917 µ. Die Nebenader trägt 12 - 15 Borsten.

♀: Dieses stimmt mit *cyrtandrae* in allen Merkmalen überein, nur ist es ein besonders grosses Stück; Flügellänge 1.04 mm. Hintereckenborsten des Pronotums 100 - 108 µ; Hauptader bisweilen mit 2 + 2 Distalborsten (Basalborsten 3 (4) + 6 (5)); Fühler vom 3. Gliede an: 86 - 92 (40), 104 - 108 (35 - 36), 60 - 64 (21), 88 - 92 (24), 16 - 17 (14), 16 - 18 (10) µ; Kopf (ungepresst) an den Augen 165, hinten 168 µ breit, Länge 152 µ; Pronotumlänge 148 µ; B. 2 des 9. Segmentes 188 - 192, B. 3: 160 µ lang.

Fundort: J a v a, Tjibodas, 1400 m, 13.VIII.1920, in Blüten von *Cyrtandra picta* (H. H. Karny leg.); Salak-Gebirge, ± 800 m, 26.X.1921, in Blüten von *Cyrtandra* (?*repens*) (Docters van Leeuwen leg.). — Die letzteren Exemplare wurden zusammen mit *Taen. lagoenifer* angetroffen.

Taeniothrips concaviceps spec. nov.

♀: Braun, Abdominalsegmente 3 - 6 hellgelb, oben mit grauen Trübungen, es mag auch Stücke geben, die noch dunkler sind; Beine dunkel, auch die Tibien stark getrübt, die Vorder- und Mitteltibien können am äussersten Ende aufgehellt sein; Tarsen gelblich; 1. und 2. Fühlerglied wie der Körper gefärbt, 3. und 4. gelblich, doch ist wenigstens das letztere etwa von der Mitte ab unscharf und schwach graulich angehaucht, das 5. etwa in der Endhälfte hellgrau, die folgenden hellgrau oder das 6. am Grunde aufgehellt; bei dunklen Stücken mögen

die Fühler dunkler, d.h. die getrübten Teile bräunlich sein. Flügel stark grau getrübt, mit einem hellen Querband hinter der Basis (doch dieses nicht vollkommen hyalin) und zwischen den beiden Längsadern sind die Flügel der Länge nach etwas aufgehellt, im Apikalteil fehlt diese Längsaufhellung.

Kopf mit stark vorgequollenen Augen, hinter diesen eine Strecke weit konkav, gegen die Basis also wieder erweitert; Scheitel daher der Quere nach breit gefurcht, mit Runzeln; vor den grob facettierten Augen ist der Kopf etwas vorgezogen; Kopflänge etwa 108, von den Augen an 88 μ lang, an den Augen 164, an der engsten Stelle 134, hinten 144 μ breit; Augenlänge (lateral) 80 - 82 μ; Anteocellar- und Interocellarborsten dünn, ziemlich lang, doch schwer messbar, die ersteren schätzungsweise 28 μ; die letzteren stehen etwa zwischen den hinteren Ocellen, oder in der Höhe ihres Vorderrandes, die ersteren (AOB) stehen seitlich vor dem vorderen Ocellus; postocellare Querreihe gut entwickelt, hinter den hinteren Ocellen, B. 2 derselben 28 μ weit hievon abstehend, ziemlich lang, etwa 32 μ, von aussen nach innen gerichtet; Mundkegel ziemlich stumpf; Fühlerlänge 363 - 380 μ; Gliederlängen (-breiten): 28 (36), 44 (30), 62 - 64 (22), 64 (22), 48 - 50 (?), 68 (?), 16 (?), 20 (6) μ; das 3. Glied hinter der Basis geschnürt, sodass ausser dem Stielchen noch ein rundlicher Basalteil abgetrennt ist, zum Ende so wie das 4. verengt, aber am Ende nicht geschnürt; Sinneskegel sehr mässig lang, vom Grunde aus schon sehr dünn, die beiden Gabeln am Grunde mit gemeinsamem Stiel, besonders deutlich am 4. Glied; Endglieder ohne Besonderheit, das 7. länger als breit; der basale Sinneskegel am 6. Glied entspringt etwas vor der Mitte des Gliedes und erreicht die Mitte des 7. Gliedes oder sein Ende, der 2. Sinneskegel liegt am Beginne des distalen Fünftels und erreicht etwa das 1. Drittel des 8. Gliedes. Pronotum 128 μ lang, 200 μ breit, viel schmäler als der Pterothorax, Scheibe ohne deutliche Skulptur, mit verhältnismässig langen und sehr dünnen gebogenen Borsten mässig dicht besetzt; die inneren Vorderrandborsten 48 - 56 μ lang, von aussen nach innen gerichtet; Hintereckenborsten sehr lang und dünn, 128 - 140 μ, schwer zu messen, da sie fast halbkreisförmig gebogen sind; innerhalb derselben mit 2 Paar ziemlich langen, feinen Borsten, von denen die innere gut 88 μ misst; Beine lang und schlank, die Schenkel und Tibien mit verh. langen, schrägabstehenden Borsten versehen, Hintertibien ausserdem innen mit einer Reihe von 12 - 14 Dörnchen. Pterothorax 303 - 312 μ breit; von der Basis der Hinterhüften 295 μ lang. Flügel sehr lang und schmal, säbelartig gebogen, 1.18 mm, Breite quer über die Höhe der ersten Distalborste 60 μ; Adern deutlich, mit sehr langen Borsten; Costa basal mit 3 - 4 mässig langen Borsten, auf die die übrigen 19 - 22 sehr langen Borsten folgen; an der Stelle, wo die 1. Distalborste der Hauptader sitzt, sind die Costalborsten etwa 216 μ lang (!); Hauptader mit 3 + 3 basalen und 1 + 2 (oder 0 + 2) distalen Borsten, Nebenader mit 11 - 12 Borsten; alle diese Borsten sind sehr lang; an der Schuppe befinden sich nur 3 Aussenrand- aber dafür 2 Diskal-Borsten. Sternite ohne accessorische Borsten; 8. Tergit ohne Kamm oder Lamellen (an den Seiten mögen einige wenige undeutliche Härchen vorhanden sein), Seiten des 8. Segmentes

mit einigen am Ende hakenförmig gebogenen Borsten, wie sie TRYBOM für *Cricothrips* angibt, wie sie aber auch bei vielen anderen *Taeniothrips*-Arten vorkommen; 9. und 10. Segment ziemlich lang, das 9. etwa 140, μ., das 10. fast röhrig (cf. *Macrurothrips*), Dorsalborsten lang, 88 - 92 μ., Hinterrandborsten 148 - 152 μ., untereinander ungefähr gleichlang, zwischen der dorsalen und der weit nach vorn gerückten Lateralborste 3 steht eine etwa 88 - 93 μ. lange, dünne Seitenborste. Borsten am 10. Segment sehr zart, daher schwer messbar, etwa 160 μ. lang, bezw. 152 μ.; 10. Segment oben nicht gespalten. Legebohrer 364 - 368 μ. lang. — Gesamtkörperlänge (stark kontrahiert): 1.315 mm.

Fundort: J a v a, G. Pangrango, ± 1800 m, 26.VI.1920, in Blattrandrollung an *Pleopeltis superficialis* BEDD. (leg. DOCTERS VAN LEEUWEN, Herb. No. 4273).

Diese grosse Art ist sehr leicht kenntlich durch die dünnen, überaus langen, gebogenen Borsten des Körpers und seiner Anhänge und ist ausserdem durch die Körperform charakterisiert, ferner die sehr zarten Sinnes-Trichome am 3. und 4. Glied, die aus gemeinsamer Basis entspringen. Ich habe auch mit der Gattung *Megalurothrips* verglichen, die durch sehr langes 9. und 10. Abdominalsegment ausgezeichnet ist; abgesehen davon, dass *concaviceps* mit *Megalurothrips typicus* BAGN. weder spezifisch noch generisch übereinstimmen kann, weil er andere Kopfform und im Verhältnis zum 9. und 10. Segment zusammen noch längeren Kopf + Prothorax, ferner anders gebaute, kleine Sinneskegel hat und wahrscheinlich viel längere Borsten der Flügel, ist sie viel eher als Vertreter eines besonderen Genus aufzufassen, das aber vorläufig nicht abgetrennt werden sollte, bis das Männchen bekannt geworden ist oder bis ähnliche Formen in grösserer Zahl oder in beiden Geschlechtern vorliegen.

Taeniothrips associatus spec. nov.

♀: Färbung braun, der Kopf meist am dunkelsten; an den Beinen die Trochantern und Tarsen hellgelb, Schenkel und Schienen braun, Vorderschienen gegen das Ende mit Ausnahme der Ränder hellgelb, Fühler dunkel, das 3. Glied ganz dunkel oder die Basalhälfte dunkel, während die Endhälfte deutlich aufgehellt bis weisslichgelb ist, das 4. und 5. Glied oder nur das erstere mit mehr weniger deutlichem Subbasalring; Flügel der ganzen Länge nach stark getrübt, Borsten dunkel. Der Thorax enthält orange-rotes Pigment. Borsten am Körper dunkel, die Hintereckenborsten des Prothorax etwas lichter.

Kopf langgestreckt, nicht nur die Schläfen (100 μ.) länger als die Augen (84 - 88 μ.), der Kopf ist auch vor den Augen vorgezogen, weshalb diese Art von KARNY (in schedis) zu *Mecothrips* gestellt wurde. Augen grob facettiert, seitlich vorgewölbt, Kopf hinter den Augen geschnürt, Schläfen aber verhältnismässig wenig gewölbt; Kopflänge samt Fortsatz 208, von den Augen an nur 168 - 172, Breite an den Augen 176, hinten 164 μ.; an der geschnürten Stelle ist der Scheitel viel dichter quergerunzelt als an der Hinterfläche; K o p f b o r s t e n s e h r g u t e n t w i c k e l t: D r e i Paar Anteocellarborsten, alle gut entwickelt, das vordere Paar etwa in der Höhe des Augenvorderrandes, schon auf der Basis des Kopfgipfels sitzend, weit voneinander abstehend, das folgende

Paar einander stark (16 μ) genähert, weiter hinten, das 3. Paar wieder etwas weiter von einander entfernt, aber doch näher als das erste Paar und seitlich noch vor dem 1. Ocellus gelegen; diese Borsten sind 40 μ (oder etwas mehr) lang; Ocellen gross; Interocellarborsten 44 - 48 μ lang, in der Höhe des Vorderrandes der Ocellen 2 - 3 gelegen, also fast zwischen diesen, ihr Abstand 18 - 20 μ, Abstand der Innenränder der Ocellen 36 μ; eine deutliche postokulare Borstenreihe umsäumt den Hinterrand der Augen, ist aber innen verdoppelt, so dass hinter den hinteren Ocellen je 2 - 3 deutliche Börstchen stehen. Kopffortsatz 36 - 40 μ lang; Maxillarpalpen schlank, 3-gliedrig, Mundkegel ohne Besonderheit, Fühler schlank, am Kopfgipfel eingelenkt; das 3. und 4. Glied am Ende halsförmig geschnürt, 4. deutlich länger als 3., das 5 schmal, zur Spitze nicht oder nur wenig verengt, eher erweitert, 6. Glied schmal, nahe der Basis am breitesten, 7. Glied lang, etwas länger als das 8. Der basale Sinneskegel des 7. Gliedes überragt die Fühlerspitze (bisweilen um die Länge des 8. Gliedes); beide Sinneskegel des 6. Gliedes stehen in der Nähe der Mitte, der eine knapp vor, der andere knapp hinter derselben. 7. Glied an der Basis schräg abgeschnitten. Fühlergliederlängen vom 3. an: 62 - 68, 72 - 84, 44 - 50, 62 - 68, 20 - 24, 18 - 20 μ. Prothorax im Verhältnis zum Kopf wenig breit, Länge 145, Breite 200 - 205 μ; Scheibe dicht mit konfluierenden Querrunzeln versehen, zwei verh. kleine Kahlstellen freilassend und ziemlich dicht mit Börstchen besetzt, ohne die Vorderrandborsten 30 Paare, mit diesen 38 Paare vorhanden; das 3. Paar Vorderrand-Borsten (von innen gezählt) ist gut entwickelt, 36 - 40 μ lang; Hinterrand zwischen den sehr langen Eckenborsten (64 - 67 μ) mit 4 Paar gut entwickelten Borsten, deren 2. von innen am längsten ist. Pterothorax mässig breit, 268 μ, Länge 286 μ; Metascutum in der Mitte etwas genetzt; Flügel breit, ihre Länge 778 - 882 μ; Costa mit ca 25, Hauptader mit 4 + 5 (4 - 6) basalen und 1 (2) + 2 distalen, Nebenader mit 10 - 13 Borsten. Innenrand der Hintertibien mit etwa 7 Borsten ausser den Apikaldornen. Sternite des Abdomens ohne accessorische Borsten; 8. Tergit mit vollständigem, aus langen, regelmässigen Haaren bestehendem Kamm; Länge des 9. Segmentes 85 μ; Dorsalborstenlänge 40 - 44, Hinterrandborsten 1: 120 - 128, B. 2: 124 - 140, B. 3: 132 - 144 μ; B. 1 des 10. Segmentes 140 - 145, B. 2: 124 - 133 μ. Legebohrer 252 μ; 10. Segment oben bis zur Borsten-Insertion gespalten.

♂: Ohne Besonderheit, etwas heller als das ♀, das 3. Fühlerglied licht, 4. nur schwach getrübt, 5. am Grunde aufgehellt; die Tibien fast ganz licht; auch beim ♂ ist das 7. Fühlerglied etwas länger und kräftiger als das 8.; das 3. - 7. Sternit trägt je ein schmales, queres Drüsenfeld, deren Ausdehnungen quer über das Segment (bei der Allotype): 68, 68, 60, 52, 48 μ betragen; Borsten am Abdomenende kräftig, das 9. Segment aber ohne besondere Auszeichnung; Kamm am 8. Tergit vollständig; am 9. Tergit stehen 4 Borsten in einer Querreihe, ziemlich weit voneinander entfernt, das innere Paar derselben länger (39 - 42 μ) als das äussere; hinter diesen, einander näher gerückt, stehen zwei borstenlose Poren, hinter diesen wiederum, noch näher, zwei kleine Borsten.

Fundort: S u m a t r a, Wai Lima, Lampongs, 13.XII.1921, im Urwalde nahe dem Rande, in jungen (noch zusammengerollten) *Amomum*-Blättern (H. H. KARNY, no. 425).

Diese Art, von KARNY auf den Etiketten als *Mecothrips* bezeichnet, ist der folgenden Art — die früher bei *Mecothrips* stand — tatsächlich sehr ähnlich, aber durch die Zahl der Anteocellarborsten und die zahlreichen, deutlich kunfluierenden Querrunzeln des Pronotums leicht zu unterscheiden, nicht nur von ,*Mecothrips*' *nomoceras* KARNY, sondern auch von der untenbeschriebenen Art *Taeniothrips amomi* n. sp.

Taeniothrips nomoceras (KARNY).

Mecothrips nomoceras KARNY, Treubia, I, 4, p. 287, figs. 9 - 12. 1921.

♀: Braun, Kopf und Abdomen etwas dunkler; Fühler dunkel, das 3. Glied hellgelb, das 4. kann am Grunde aufgehellt sein; Flügel ungefähr gleichmässig stark getrübt, Schenkel dunkel, a b e r d i e S p i t z e n h e l l g e l b, Tibien zum grossten Teil hellgelb, die Mittel- und Hintertibien aber bisweilen ganz schwach getrübt; Körperborsten dunkel. Rotes Pigment im Thorax spärlich vorhanden.

Die grösste Art unter den verwandten. Kopf samt Gipfel 192 - 196 μ, vom Vorderrand der Augen 160 μ lang, Breite etwa 180 μ; Augen 84 - 88 μ; Kopffortsatz 32 - 36 μ; Interocellarborsten wohl entwickelt, wie bei *T. associatus* gestellt; 1 Paar lange, stark gekrümmte Anteocellarborsten, die an der Basis des Kopfgipfels, etwa in der Höhe des Vorderrandes der Augen stehen; Kopf hinter den Augen geschnürt, Augen vorgequollen, Scheitel mit dichten Querrunzeln, die in der Schnürung normal, hinten lockerer liegen; eine Kette kleiner Postokularbörstchen zieht um die Augen, hinter den hinteren Ocellen nur 1 Börstchen (etwa 20 μ von ihnen abstehend); Maxillarpalpen u n d e u t l i c h-dreigliedrig, das 2. und 3. Glied nicht ringsum getrennt; Fühler 380 - 400 μ lang; Gliederlängen (-breiten): 28 - 31 (34), 42 (32), 73 (27), 81 (22), 53 (17), 74 (19), 17 - 18 (11), 17 (8) μ; das 3. und 4. Glied am Ende halsförmig geschnürt, beide mit langen Trichomen, die am 3. Gl. 88 - 92 μ messen, der proximale Sinneskegel des 6. Gliedes knapp vor der Mitte gelegen, erreicht etwa die Mitte des folgenden (7.) Gliedes, der distale Kegel (am Beginne des Enddrittels) erreicht die Mitte des 8. Gliedes; das 7. Glied an den Seiten deutlich gerundet, so lang oder etwas länger als das 8.; 4. und 5. Glied mit Subbasalring. Pronotum 136 μ lang, etwa 212 μ breit, seine Fläche viel weniger dicht mit Börstchen versehen als bei *associatus*, die Runzeln der Oberfläche wie gewöhnlich (n i c h t sehr fein und dicht wie bei *associatus*), die beiden Kahlstellen viel grösser als bei *associatus;* einschliesslich der Vorderrandborsten sind nur etwa 23 Paar Scheibenborsten vorhanden, 18 Paar ohne die ersteren; die äusseren Hintereckenborsten 80 - 85, die inneren 88 - 98 μ lang; innerhalb derselben mit normalerweise 3 Paar Börstchen, von denen die innerste (44 - 48 μ) die längste ist. Pterothorax etwa 310 μ breit, 346 μ lang, Flügellänge 0.986 - 1.0 mm, Hauptader

mit 4 + 4 (-6) basalen und 1 + 2 distalen, Nebenader mit 12 - 14 Borsten. Abdomen schlank, Sternite ohne accessorische Borsten, 8. Tergit mit langem, vollständigem, dichtem Kamm; die Hinterränder der vorderen Tergite an den äussersten Seiten mit rudimentären Zähnchen. 9. Segment 108 μ lang, Dorsalborsten 76, Hinterrandborsten 1: 120 - 144, B. 2, 3: 168 - 175 μ lang; B. 2 am 10. Segment 167 - 176 μ, das 10. Segment oben ungefähr bis zur Borstenbasis (oder etwas mehr) gespalten. Legebohrer 288 μ lang; Hintertibien am Innenrand (ausser den Apikalsporen) mit 9 Börstchen.

Männchen unbekannt.

Fundort: Java, Tjibodas, 13.VIII.1920, in jungen, noch zusammengerollten Blättern von *Amomum coccineum* (leg. DOCTERS VAN LEEUWEN; ex coll. H. H. KARNY).

Die Beschreibung dieser Art (l.c.) wurde hiemit nach neueren Gesichtspunkten ergänzt.

Taeniothrips amomi spec. nov.

Diese Form ist dem *T. nomoceras* äusserst ähnlich, sie ist jedoch bedeutend kleiner, und alle Exemplare stimmen hierin überein, so dass ich mich nicht entschliessen kann, die beiden Formen *nomoceras* und *amomi* zusammenzulegen.

♀: Färbung wie bei vorigem, das 3. Fühlerglied bei lichten Stücken hellgelb, bei dunklen stark grau getrübt, sodass die Fühler fast einfarbig graubraun sein können.

Kopf etwas weniger gestreckt als bei vorigem, die Struktur dieselbe, nur die Elemente der Postocularborsten-Reihe sind einander etwas näher gerückt. Kopf samt Gipfel 172, von den Augen an 144 μ lang, 148 - 160 μ breit. Auch hier sind die Maxillartaster praktisch 2-gliedrig. Fühler kürzer, 355 - 363 μ; Gliederlängen (-breiten): 25 - 28 (36), 41 - 42 (28), 66 - 67 (24), 69 - 70 (22), 46 - 48 (15), 69 - 70 (17), 15 - 16 (9), 14 - 17 (7) μ; das 3. und 4. Glied am Ende geschnürt, Sinneskegel am 3. Gl. 72 - 76 μ lang; 7. Glied seitlich kaum gewölbt; Skulptur und Beborstung der Pronotum-Scheibe wie bei *nomoceras*, Pronotum ebenso lang, 128 - 136 μ, aber die Hintereckenborsten kürzer, etwa 64 und 72 μ lang; innerhalb derselben stehen 3 Paar (selten 2), das innerste höchstens 36 μ lang; Pterothorax 234 - 260 μ breit, 277 μ lang; Flügel kürzer als bei *nomoceras*, etwa 780 μ lang, Beborstung der Hauptader dieselbe, Nebenader mit 11 - 12 Borsten. Abdomen wie bei vorigem, 9. Tergit 96 μ lang, Dorsalborsten 52, B. 1 des Hinterrandes 132 - 135, B. 2, 3: 148 - 152 μ lang, B. 2 am 10. Segment 148, B. 1: 160 μ, sonst wie bei vorigem. Legebohrer 272; Hintertibien, ausser den apikalen, am Innenrand mit etwa 7 Borsten.

♂: Sternite 3 - 7 mit je einem breiten, queren, in der Mitte etwas verengten Drüsenfeld. — Masze (Allotype) in μ: Kopflänge samt Fortsatz 136, ohne diesen 116, Breite an den Augen 128 - 130; Fühlerlänge 295; Gliederlängen 24 - 25, 34, 52 - 55, 56 - 59, 38, 56, 13, 13.5; Pronotum 104 - 108 lang, 160 breit, Hintereckenborsten 52 - 60; Pterothoraxbreite 188; Flügellänge 606; Lateralborsten

am 9. Segment 108; Drüsenfelder (3. - 7. Sgm.) 68 - 72, 72, 68, 64, 62 - 64. — Accessorische Borsten fehlen; Borsten am Dorsum des 9. Segmentes etwa wie bei *associatus,* aber von dieser Art durch den Besitz von nur 1 Paar anteocellaren Borsten (anstatt 3) und das viel weniger fein quergestreifte Pronotum leicht zu unterscheiden.

Fundort: S u m a t r a, Wai Lima, Lampongs, in zusammengerollten Blättern von *Amomum,* 7.XII.1921 (H. H. Karny No. 346), zusammen mit *Taeniothrips associatus.*

Taeniothrips montivagus spec. nov.

Priesner, Philippine Journ. Sci., 57, p. 355, 356. — 1935.
Priesner, Stylops, IV, p. 129. — 1935.

♀: Schwarzbraun, nur gebleichte Stücke lichtbraun; die Beine ganz dunkel, Tarsen graugelblich; Flügel gleichmässig stark getrübt, an der Basis oft deutlich lichter (aber niemals hyalin), meist nur mit einem grösseren, hellen ovalen Fleck hinter der Basis; Fühler dunkel, das 3. Glied lichter als die folgenden aber n i c h t hellgelb, immer deutlich, oft stark getrübt mit Ausnahme des hellen Stielchens. Borsten am Körper dunkel.

Grosse Art. Gestalt ähnlich wie bei *oreophilus* m.; Kopf länglich, von den Augen an 168, samt IAF 200 μ lang, an den Augen 172 - 176, hinten 176 μ breit, mit stark vorspringenden Augen, hinter ihnen geschnürt, Wangen gewölbt; Kopf nach vorn deutlich etwas vorgezogen, hinter den Augen der Quere nach etwas eingesattelt, Interocellarborsten sehr lang, fast zwischen den hinteren Ocellen (nahe dem Vorderrand derselben, bisweilen sogar etwas vor diesem), etwa 100 (oder mehr) μ lang, 1 Paar viel kleinere Anteocellarborsten liegen an den Seiten des vorderen Ocellus, nahe den Netzaugen; eine deutliche Querreihe Postokularborsten, innen einander und dem Augenhinterrande näher gerückt als seitlich; Augen seitlich 88 - 96 μ lang; von den 6 Paar Stirnborsten ist das 5. Paar von den inneren Hinterecken der Augen weiter entfernt als bei *T. miorhizae;* Hinterrand des Scheitels dick, schwärzlich; Mundkegel und die deutlich 3-gliedrigen Maxillarpalpen (22 (11), 15 (7), 25 (2 - 5) μ) ohne Besonderheit; Fühler 440 - 476 μ lang; Gliederlängen (-breiten): 40 (B. 36), 56 (32), 92 (28), 92 - 96 (27), 56 - 58 (22), 82 (25), 14 - 16 (11), 22 - 24 (8 - 8.5) μ; das kleinste vorliegende Stück, misst vom 3. Gliede an: 80, 80, 52, 74, 14, 20 - 22 μ; das 3. Glied von oben gesehen vor dem Ende etwas geschnürt, das 4. nur wenig, von der Seite gesehen gar nicht geschnürt; Sinneskegel gut entwickelt, am 4. Glied 80 - 84, am 3. 76 μ lang; beide Sinneskegel des 6. Gliedes sind zwischen Mitte und Spitze des Gliedes gelegen; Sinneskegel des 7. Gliedes (vor der Mitte entspringend) überragt nicht die Fühlerspitze. Pronotum 172 - 176 μ lang, ungepresst 225 - 242 μ breit; Scheibe nur sehr spärlich mit Borsten besetzt, Vorderrand nur an den Seiten mit Borsten (etwa 3 - 4 Paare); Hinterecken-Borsten sehr lang, 132 - 140 μ, Hinterrand innerhalb der Eckenborsten mit gewöhnlich 3 Paar Borsten, von denen die beiden äusseren klein sind und dem Rande ganz nahe stehen, während die 3., innerste bedeutend grösser (48 μ) ist und vom Hinterrande weiter ab-

gerückt steht. Beine schlank, Hintertibien am Innenrande mit regelmässiger Reihe von 12 - 14 Börstchen (abgesehen v. d. beiden Apikalsporen). Pterothorax 355 - 363 μ breit und 398 - 415 μ lang; das mittlere Borstenpaar am Vorderrande des Metascutum über 68 μ lang, überragt bedeutend die beiden einander stark genäherten borstenfreien Poren, die vom Hinterrande etwa so weit abstehen wie vom Vorderrande; Flügel schlank, 1.35 - 1.5 mm lang; Schuppe mit 5 - 6 Vorderrandborsten, Costa mit 35 (oder mehr), Hauptader mit 3 (4) + 4 - 8 basalen und 1 + 2 (selten 2 + 2 oder nur 2) distalen, Nebenader mit 14 - 19 Borsten; Borsten am Abdomen lang, Sternite o h n e accessorische Borsten; 2. Tergit mit nur 3 lateralen Borsten, 8. Tergit mit sehr langem, regelmässigen und sehr dichten Kamm, Stigmenhöcker an den Seiten deutlich; 9. Segment, Dorsalborsten 100 - 108, Hinterrandborsten, B. 1: 148 - 156, B. 2, 3: 180 - 185 μ; B. 1 am 10. Segment 188, B. 2: 168 μ; 10. Segment bis zur Borstenbasis oder etwas darüber hinaus gespalten; Legebohrerlänge ca 305 μ. — Körperlänge (gedehnt): 2.16 - 2.21 mm.

♂: In der Färbung und auch sonst wie das ♀ oder nur wenig lichter; Fühlerlänge 380 μ; Gliederlängen (-breiten): 36 (34), 44 (28), 76 (22), 74 (22), 36 (20), 72 (22), 12 (10), 18 (8) μ; Kopf an den Augen 154, hinten 146 μ breit, Prothoraxbreite 192, Pterothoraxbreite 286 μ, Flügellänge 1.12 mm. Nebenader mit 13 - 15 Borsten; Drüsenfelder der hinteren Sternite deutlich schmäler als die der vorderen: 84 (16), 80 (16), 76 (20), 72 (20), 64 (20) μ. Sternite ohne accessorische Borsten. Hintertibien 252 μ lang, innen mit regelmässiger Reihe von 12 Börstchen; 9. Tergit mit 6 Borsten in zwei Querreihen (2 + 4 B.). — Körperlänge (normal gedehnt): 1.4 mm.

Fundorte: J a v a, Pangrango-Gipfel (3060 m), 30.VII.1920, in Blüten von *Hypericum hookerianum* W. et A.; Pangrango (in 3000 m Höhe), 18.II.1921, in Blüten von *Polygonum chinense;* DOCTERS VAN LEEUWEN leg. — Pangrango (3000 m), 1923, no. 58 (leg. H. H. KARNY); Tjibodas, VIII, 1921, 1400 m (leg. H. H. KARNY, No. 339). — Goen. Lawoe, 3200 m, 18.XI.1924, ♀ an *Polygonum chinense,* und Gipfel Tjikorai, 2800 m, 2.V.1925, 1 ♀ im Fluge (DOCTERS VAN LEEUWEN leg.).

T. montivagus ist unter den dunklen Arten durch die nicht vasenförmige Gestalt des 3. und 4. Fühlergliedes, durch die stark vorgequollenen Augen und die Schnürung hinter denselben, dem *T. alticola* PR. und *T. miorhizae* n. sp. ähnlich;*alticola* hat lichtes 3. und am Grunde aufgehelltes 4. Glied der Fühler und an der Basis hellgelbe Hintertibien, ist aber strukturell äusserst ähnlich; ich musste sie hingegen getrennt behandeln, da weder in dem *Polygonum-* noch in dem *Hypericum*-Material des *T. montivagus* sich die von mir als *alticola* beschriebene Form fand, was zu erwarten gewesen wäre, wenn es sich um blosse Farbenformen handeln würde. *T. miorhizae* ist durch die Beborstung des Kopfes, die wenig gewölbten Wangen, grösseren Ommatidien der Netzaugen und durch dünneren Stylus ganz verschieden; *T. major* BAGN. ist durch die Stellung der dorsalen Kopfborsten von allen dreien leicht zu trennen.

Taeniothrips pallipes BAGNALL.

BAGNALL, Ann. Mag. Nat. Hist., Ser. 8, vol. XVII, p. 400. — 1916.
MOULTON, Annot. Zool. Japon., 11, 6, p. 302, 326. — 1929.

Die von BAGNALL gegebene Originalbeschreibung genügt unseren gegenwärtigen Bedürfnissen nicht mehr, ich habe sie daher — auf Grund von 2 Cotypen — hiemit erneuert.

Körper dunkel, Vorderkörper orange aber gleichzeitig stark getrübt (Färbung d. *Thrips parvus* SCHM.); Beine gelb, Vorder- und Mittelschenkel fast nur am Aussenrand, Hinterschenkel mit Ausnahme der Basis fast ganz getrübt, Tibien hellgelb, nicht oder am Aussenrand ganz leicht getrübt; Flügel stark getrübt, an der Basis stark aufgehellt, aber nicht völlig hyalin. Borsten dunkel. 1., 2. und 6. - 8. Fühlerglied ganz dunkel, 3. hellgelb, 4. und 5. dunkel, aber etwa im basalen Drittel lichtgrau aufgehellt. Hinterrandlinie des Scheitels dunkel.

Kopf von den Augen an 108 - 110, im ganzen 120 μ lang, unter leichtem Druck an den Schläfen 164 μ breit; Augenlänge 64 - 66; Schläfen gewölbt; Interocellarborsten deutlich ausserhalb der Tangente, Länge 26 μ; innerste Postocellaren 28 - 30 μ, sehr deutlich, getrübt. 3. und 4. Fühlerglied am Ende verengt, aber nicht geschnürt; Masze v. 3. Gliede an: 54 - 60, 52 - 58, 42, 56, 7 - 8 (6), 10 μ; Sinneskegel mässig lang. Pronotum 124 μ lang, 208 μ breit; 5 - 6 Paare nach innen gerichteter Borsten am Vorderrande, 20 - 23 Paare Diskalborsten, 3 Paar Borsten innerhalb der Hintereckenborsten, dass innerste 24 μ, Hinter ecken borsten 50 - 54 μ, äussere 56 μ; Mesothorax 277 μ breit; das mediane Dorsalborsten-Paar des Metascutum am Vorderrande gelegen, 48 μ lang; Flügel 474 - 779 μ. Costa mit etwa 30, Hauptader mit 4 + 3 basalen und 1 + 2 distalen Borsten, Nebenader mit 14 - 18 Borsten. 2. Tergit seitlich mit vier dunklen Borsten, auch deren 1. Borste deutlich; vordere Sternite mit ziemlich regelmässigen Reihen accessorischer Borsten; 2. Sternit mit 2 - 3 Borsten in der Mitte, die folgenden mit einer Querreihe, am 7. Sternit sind 8 - 9 Paare vorhanden, seitlich 2 - 3 Paare verdoppelt; Kamm am 8. Tergit vollständig, aber nur mässig lang; Porus und Medianborsten am 8. Tergit haben ziemlich gleiche Abstände voneinander; 10. Tergit über die Borstenbasis hinaus gespalten, Borsten am 9. Segment, B. 1: 84 - 86, B. 2: 96 - 104, B. 3: 92 - 105 μ lang; B. 1 des 10. Segmentes 100 - 105, B. 2: 94 - 100 μ lang. Hintertibien innen ausser den Endsporen mit etwa 11 hellen Dörnchen.

Japan, Kobe, 15.XI.1915, an Chrysanthemen (leg. J. E. A. LEWIS).

Eine Form mit ganz dunklen Fühlergliedern 4 und 5 sei als var. *florinatus* nov. bezeichnet (Holotype: coll. MOULTON no. 1880, China, Kashing, Che-Kiang Prov., 17.III.26, in flowers of Broad Beans); Japan, Kyoto, 1.IX.26, H. YUASA, MOULTON no. 1698; Formosa, Taihoku, in Rosenblüten, 9.II.27, R. TAKAHASHI, MOULTON no. 1698.

Zusammen mit der typischen Form wurde var. *florinatus* auch auf Java

(in Teeblüten, 1921, leg. W. C. VAN HEURN), und auf S u m a t r a (Bandarbaroe, ± 800 m, IX.1920, in Blüten von *Thea assamica,* leg. W. DOCTERS VAN LEEUWEN) gefunden.

Taeniothrips major BAGNALL.

BAGNALL, Ann. Mag. Nat. Hist., ser. 8, vol. XVII, p. 216. — 1916.

Auch von dieser Art gebe ich auf Grund einer Cotype eine ergänzende Beschreibung.

♀: Schwarzbraun, Flügel stark getrübt, Längsadern sehr deutlich, Flügel an der Basis e t w a s lichter, aber nicht hyalin, zwischen den Adern der Länge nach etwas aufgehellt, distal nicht aufgehellt; Beine und Fühler ganz dunkel, das 3. Fühlerglied nur etwas lichter als die anderen.

Kopf hinter den Augen stark geschnürt, vom Vorderrand der Augen 180, total 204 µ lang, an den Augen 188, an den stark gewölbten Wangen 180 µ breit; Scheitel hinten eingebuchtet; Augendurchmesser 86 µ; Interocellarborsten sehr lang, mindestens 92 - 96 µ, z w i s c h e n d e n h i n t e r e n O c e l l e n gelegen, Anteocellarborsten kleiner, aber sehr deutlich, etwa 48 µ voneinander abstehend, w e i t v o r d e m v o r d e r e n O c e l l u s, an den Seiten der Netzaugen. Fühlergliederlängen: vom 3. Gliede an: 104 - 108, 96 - 100, 60, 88 - 89, 12 - 13, 16 - 18 µ; das 3. und 4. Fühlerglied am Ende kurz halsförmig, der Innenrand der Sinneskegelbasis vom Fühlerende 22 µ entfernt; 6. Glied etwa spindelförmig; Borsten am 3. Glied 48 µ lang, dunkel. Prothorax etwa 174 µ lang, 260 µ breit; innere Hinterecken-Borsten 120, äussere etwa 100 - 105 µ lang, innerhalb derselben drei Paare Posteromarginal-Borsten. Pterothorax 415 µ breit, Flügel 1.64 mm lang; Costa der Vorderflügel mit 34 - 35, Hauptader mit 3 + 7 basalen und 1 + 2 distalen Borsten, Nebenader mit 17 Borsten. Accessorische Sternitborsten f e h l e n. Tergit 1 mit einem Porenpaar, dessen Elemente voneinander etwas abstehen, etwa wie bei *gracilis* MLT., Tergit 8 am Hinterrande mit regelmässigem langem Kamm, Dorsalporen dem inneren Borstenpaar stark genähert; Dorsalborsten am 9. Segment etwa 120 µ lang, Hinterrandborsten 2,3: 200 - 212 µ, B. 2 am 10. Segment 180 µ lang, Legebohrer ? 330 µ.

I n d i a, Kulhara, Garhwal, 11,700 ft, 5.VI.1910, in Blüten von *Rhododendron* (A. D. IMMS).

Taeniothrips miorhizae spec. nov.

♀: Dunkelbraun, Beine dunkel, meist die Basis der Tibien ringartig lichter, die Tarsen gelblich; Fühler dunkel, das 3. Glied bedeutend lichter als die übrigen, aber nicht rein hellgelb, sondern graugelb; Flügel stark getrübt, der Basalteil (mit Ausnahme der stark getrübten Schuppe) etwas lichter, doch noch überall ausgesprochen getrübt. Borsten dunkel.

Kopf hinter den Augen stark geschnürt, Scheitelhinterrand dunkel gesäumt, tief ausgerandet, Kopflänge 145, mit IAF 166 - 190 µ lang, an den Augen 174,

hinten 160 μ breit; Wangen nicht oder wenig gewölbt (nur bei geschrumpften Stücken etwas), Augenfacetten unten polygonal aneinanderstossend, oben mehr rundlich, Facetten aber deutlich grösser als bei *T. montivagus;* Augen deutlich behaart; Anteocellarborsten am Innenrande der Netzaugen, in der Höhe des ersten Ocellus gelegen, Interocellarborsten lang, zwischen den hinteren Ocellen, d.h. in der Höhe ihres Vorderrandes gelegen; das 5. Stirnborstenpaar, das an den Stirnecken der Augen gelegen ist, ist diesen viel näher gerückt als bei *montivagus.* Fühler der Holotype 450 μ, Gliedermasze derselben: 40 (B. 36, Sp. 31), 52 (31), 90 (27), 96 (24), 56 (20), 74 (21), 16 (10), 24 (6) μ; bei grösseren Stücken: 40 (B. 39, Sp. 32), 56 (31 - 32), 96 (29), 110 (25), 60 (20), 86 (21), 17 (9), 26 (6) μ; 3. und 4. Glied am Ende geschnürt, flaschenförmig, Sinneskegel lang, am 4. Gl. 72 - 84 μ, 4. und 5. Glied mit ringförmiger Absetzung an der Basis, der Stylus bedeutend schlanker als bei *montivagus;* Prothorax 218 - 240 μ breit, 174 μ lang, hinten am breitesten, Hinterecken-Borsten 144 - 170, äussere 120 - 156 μ lang, gebogen, Basis innerhalb derselben mit 3 Paar Börstchen, von denen das innerste viel länger ist als die kleinen äusseren, 60 - 64 μ messend. Pterothorax 337 - 390 μ breit, Länge 397 - 450 μ; Flügellänge 1.29 - 1.47 mm; Schuppe mit der normalen Borstenzahl, Costa mit über 30, Hauptader mit 3 bis 4 plus 4 bis 8 basalen und 1 + 2 distalen Borsten, Nebenader mit 14 - 17 Borsten. Sternite ohne accessorische Borsten; 8. Tergit mit sehr langem, vollständigem, dichtem Kamm; Borsten am 9. Tergit B. 1: 148 - 159, B. 2: 173 - 188, B. 3: 184 - 190, dorsale 95 - 105 μ lang; 10. Segment oben etwa bis zur Borstenbasis gespalten oder aber geschlossen und nur zwischen den B. 1 gespalten; 3. Tergit 105 μ lang, B. 1, 2 am 10. Segment 180 - 188, B. 2 am 10. Segment 168 μ lang. 2. Tergit seitlich mit 3 Borsten. Legebohrerlänge 294 - 312 μ.

♂: Sehr ähnlich dem des *montivagus,* aber das Fühlerende, besonders der Stylus schlanker, die Drüsenfelder der Sternite grösser, hantelförmig, die Wangen nicht gewölbt; 3. Fühlerglied hellgelb, oben leicht schattiert. Fühler der Allotype vom 3. Gliede an: 80, 84 - 86, 48, 92 - 94, 12, 18 - 20 μ; das 2. Stylusglied zum Ende stark verengt, der längere Innenast des Sinneskegels am 4. Glied 56 - 60 (bei *montivagus* 48) μ; Flügellänge etwa 1.038 mm, Pterothoraxbreite 295 μ. Masze der Drüsenfelder (vom 3. - 7. Sgm.): 14 (96), 18 (92), 22 (92), 24 - 26 (98), 24 (92) μ; die vorderen 2 - 3 Felder sind in der Mitte deutlicher, die hinteren weniger deutlich verengt; die längste Lateralborste am 9. Segment misst 104 - 108 μ; Anordnung der Dorsalborsten ähnlich wie bei *montivagus.*

Von *T. montivagus* ist diese Art im weiblichen Geschlechte durch die grösseren Facetten der Augen, die nicht oder kaum gewölbten Wangen, die schlankeren Fühler, speziell die längeren drei Endglieder, und die längeren Sinneskegel, spezifisch verschieden.

Fundort: Java, Tjibodas, 2000 m, 27.II.1922 — mit rosa Larven — in Blüten von *Miorhiza longiflora* (leg. DOCTERS VAN LEEUWEN); 1 ♀, Tjibodas, 1400 m, 13.VIII.1920, in Blüten von *Cyrtandra picta.* Exemplare aus Blüten von *Leucaena glauca* BENTH. (Semarang, 6.VII.12, leg. D. v. L.) gehören wahrscheinlich auch zu dieser Species, doch bin ich dessen nicht ganz sicher.

Taeniothrips rhodomyrti spec. nov.

♀: Schwarzbraun, Ocellen mit rotem Pigment, Scheitel-Hinterrandlinie und die schmalen Vorderränder der Tergite schwarz; Beine gelb, Vorderschenkel am Aussenrand stark getrübt, Hinterschenkel dunkel (bei dunklen Stücken mögen die Aussenränder der Tibien schmal getrübt sein); Flügel der ganzen Länge nach gleichmässig getrübt, ohne basale Aufhellung; Fühler dunkel, 3. Glied hellgelb, 4. und 5. Glied dunkel, nur nahe der Basis ganz schmal gelblich aufgehellt, oder das 4. und 5, in der Grundhälfte aufgehellt (nicht rein hellgelb), auch das 6. im Grunddrittel lichter als im übrigen Teil. Borsten dunkel.

Eine zarte Art mit verhältnismässig kurzen Flügeln, dem *Thrips parvus* SCHM. habituell ähnlich; Kopfform etwa wie bei *Thrips fuscipennis;* Augendurchmesser etwa 60 μ, Kopflänge 104, von den Augen an 90, Breite an den Augen 140 - 145 μ; Interocellarborsten in- oder etwas ausserhalb der Tangente, etwa 24 - 28 μ, gut sichtbar, weil dunkel, Postocellarborstenreihe einfach, innerstes Börstchen sehr deutlich, etwa 25 μ; Anteocellarborsten sehr klein, vor dem vorderen Ocellus, seitlich am Innenrande der Netzaugen; Maxillarpalpen schlank, Glieder 14, 8 - 11 und 20 lang; Fühler etwa 277 μ lang, Gliedermasze: vom 2. an: 36 (22), 53 (17), 53 (17), 39 (14), 50 (16), 7 (6), 7 (5) μ; das 3. und 4. Glied am Ende ganz wenig geschnürt, Sinneskegel mässig lang, am 4. Gliede etwa 24 μ; der längere Sinneskegel am 6. Glied überragt das 7. Glied etwas. Pronotum 98 μ lang; Hinterrand mit 3 Paar inneren Börstchen, posteromarginale kurz, 40 - 44 μ; von den Vorderrandborsten sind 5 Paare nach innen gerichtet, die Pronotum-Scheibe trägt etwa 18 Paar Börstchen. Vorderbeine einfach; Pterothorax etwa 225 - 235 μ breit, innere Vorderrandborsten des Metascutums 44 - 46 μ, in der Höhe der äusseren gelegen, also am Vorderrande; Flügellänge 588 - 640 μ; Costa mit etwa 26 (mässig langen), Hauptader mit 4 + 3 basalen und 1 + 2 distalen, Nebenader mit 11 - 13 Borsten. Hintertibien mit 8 - 9 gelblichen Börstchen am Innenrande, ausser den Apikalsporen. 2. Tergit am Seitenrande mit 4 Börstchen, die beiden Dorsalborstenpaare am 8. Tergit dem Porus nahe, mitunter der Porus zwischen den Börstchen. Hinterrand des 8. Tergites breit und seicht eingebuchtet, Kamm sehr zart, aber vollständig. 2. Tergit in der Mitte 50, 8. Tgt. 56, 9. Tgt. 52 - 54, 10. Tgt. 68 μ lang; Borsten 1 am 9. Segment 56 - 65, B. 2, 3: 72 - 80 μ, B. des 10. Segmentes etwa 80 μ; 10. Segment oben bis weit über die Borstenbasis gespalten, der Spalt aber die Segmentbasis nicht erreichend, da das Segment verh. lang ist (Abstand v.d. Basis zur Borstenbasis etwa 45 μ; Legebohrerlänge 256 - 260 μ. Sternite mit zahlreichen accessorischen Borsten, die je aus ungefähr 1 Querreihe bestehen (4. - 6. Segment), am 7. Sternit sind etwa 5 - 7 Paar accessorische Borsten vorhanden.

♂: Hellgelb mit ebensolchen Beinen, Flügeln und 1. - 3. Fühlerglied; 4. Fgl. und 5. im Enddrittel deutlich getrübt, das 6. dunkel, am Grunddrittel (oder mehr) hellgelb. Masze: Kopfbreite 132 μ, Prothoraxlänge 108, Breite 152 - 156 μ; Pterothoraxbreite 190 μ, Flügellänge 536 μ; Fühlerlänge: 260 - 268 μ; Glieder:

vom 2. an: 34 - 35 (22), 50 (15), 48 (14), 36 (13), 52 (15), 6, 7 μ; Hintereckenborsten des Prothorax 52 - 56, äussere 44 - 48 μ; Dorsalborsten des Metascutums 40 - 45 μ, Lateralborsten des 10. Segmentes 112 μ. — Flügelborsten wie beim ♀; Drüsenfelder sehr schmal und in die Breite gezogen, hinter denselben und seitlich sehr reichlich von accessorischen Börstchen umsäumt; am 9. Tergit stehen 4 Borsten in einer Querreihe.

Fundort: Riouw Archipel, Doerian, 12.VI.1923, aus Blüten von *Rhodomyrtus tomentosa* Wight (leg. Dammerman, No. 8).

Diese Form ist auf den ersten Blick dem *Thrips parvus* sehr ähnlich, unterscheidet sich aber — abgesehen vom 2-gliedrigen Stylus — durch die schlankeren Fühler, die noch kürzeren Pronotumborsten, das eingebuchtete 8. Tergit, die bedeutendere Länge der Segmente (Tergite), besonders das längere 10. Unter den *Taeniothrips*-Arten steht *pallipes* Bagn. am nächsten, der aber durch relativ kürzeres 10. Segment des Abdomens, die längeren, an der Basis aufgehellten Flügel, die längeren Körperborsten und den geraden Hinterrand des 8. Tergites wesentlich abweicht.

Taeniothrips pavettae spec. nov.

♀: Braun bis dunkelbraun, Beine dunkel, Vordertibien lichter oder alle Tibien innen licht, Tarsen licht; Fühler dunkel, 3. Glied am Stielchen licht, das 4. und 5. Glied mit wenig deutlichem, hellem Subbasalring; Borsten dunkel; Flügel gleichmässig stark getrübt, mit kleiner Basalareola.

Eine kleinere Art mit grossen Augen und grossen Facetten, besonders einige mittlere Facetten sehr gross. Kopflänge 128 - 144 (samt IAF 144 - 156) μ, Breite an den Augen 168, hinten 164 μ; Augen etwa 92 - 105 μ lang; Kopf hinter den Augen ganz kurz geschnürt, Wangen aber von hier ab geradlinig nach hinten verengt; Anteocellarborsten sehr klein, am Innenrande der Netzaugen, in der Höhe des 1. Ocellus gelegen, Interocellarborsten sehr mässig lang, an oder etwas innerhalb der Tangente gelegen; postokulare Reihe dicht am Augenhinterrande, auch ihr innerstes Börstchen sehr klein; die hinteren Ocellen dicht am Innenrande der Netzaugen. Maxillarpalpen schlank, die Trennungslinie zwischen 2. und 3. Glied bisweilen undeutlich. Fühler 346 μ lang; Gliederlängen (-breiten): 22 - 28 (?), 45 (30), 64 - 66 (24 - 27), 64 - 67 (24 - 25), 42 (17 - 18), 76 - 78 (20), 6, 8 μ. Pronotum 148 - 160 μ lang, 205 μ breit, Borsten an den Hinterecken 76 - 80 μ lang; Scheibe spärlich etwa mit nur 11 - 14 Paar Börstchen besetzt, und nur zwei Paar inneren Posteromarginalen; Pterothorax 277 μ breit; die mittleren Borsten der Basis des Metascutums, etwa 48 μ lang, die borstenlosen Poren dahinter voneinander weiter entfernt als vom Hinterrande; Flügel 804 - 880 μ lang, Costa mit 25 - 28, Hauptader mit 4 + 3 basalen (mit einem hellen Fensterfleck dazwischen) und 1 + 1 + 1 distalen Borsten, Nebenader mit 11 - 14 Borsten; Schuppe mit der normalen Zahl (5 + 1) Borsten. Das mediodorsale Borsten-Paar des 1. Tergites etwa 42 μ voneinander entfernt, das Borstenlose Porenpaar 56 μ, also fast so weit, die Poren aber vom Hinterrande des Tergites kaum mehr als um den Porendurchmesser entfernt; 2. Tergit am

Seitenrande mit 4 Borsten; Sternite mit accessorischen Borsten in ziemlich regelmässiger Querreihe, am 7. Sternit sind 4 - 5 Paare vorhanden; Kamm am 8. Tergit vollständig, zart. B. 1 am 9. Segment 104 - 120, B. 2: 124 - 128, B. 3: 128 - 132 μ lang.

♂: Braun bis lichtbraun, wenig lichter als das Weibchen, Thorax mit etwas orange; Fühler einfarbig heller oder dunkler graubraun, die beiden ersten Glieder dunkler als die übrigen; Beine bräunlichgelb bis graubraun, die Schenkel und Schienen bei lichten Stücken am Aussenrand getrübt, die Vorderschenkel auch an der Spitze; Flügel schattiert, an der Basis wenig aufgehellt. Kopfbreite 140 - 145 μ; Fühlergliederlängen (-breiten): 28 (28), 42 (25), 59 (18), 55 - 56 (17), 38 (15), 62 (16), 6, 8 μ; Pronotum 168 μ breit, Borsten an den Hinterecken 64 - 66 μ; Pterothorax 225 μ breit, Flügel 675 - 692 μ lang, Hauptader mit 4 + 4 (oder 4 + 3) basalen und 1 + 2 distalen Borsten. Innenrand der Hintertibien mit 13 - 15 Borsten, der längste Tibien-Sporn misst 32 - 34 μ. Seitenborste am 9. Segment etwa 92 μ; Drüsenfelder gross und breit (jedoch bei keinem der Stücke gut messbar), in der Mitte verengt, hinten mit einer Reihe accessorischer Borsten; von den vier in einer Querreihe stehenden Borsten des 9. Tergites sind die inneren viel länger als die äusseren.

Fundort: Sumatra, Sibolangit, 1480 m, IX.1920, wenige Exemplare, in Blüten von *Pavetta indica* L. (leg. DOCTERS VAN LEEUWEN).

Die wenigen vorhandenen Stücke sind nicht perfekt präpariert, doch genügen die obigen Angaben vollkommen, diese Art danach wiederzuerkennen. Sie ist unter den Arten mit 3 Distalborsten, welche accessorische Sternit-Borsten haben, durch die gleichmässig gefärbten Fühler und den kurzen Stylus nur mit *Taen. tristis* n. sp. zu vergleichen, welch letzterer aber schon durch die Grösse und seine Borstenmasze gänzlich verschieden ist.

Taeniothrips tristis spec. nov.

♀: Dunkelbraun, mit rötlicher Tönung, Tibien und Tarsen ebenfalls dunkel, aber doch wenigstens am Innenrand und gegen die Spitze etwas aufgehellt, im ganzen lichter als der Körper. Fühler ganz dunkel, nur das Stielchen des 3. Gliedes weisslich. Borsten dunkel. Flügel stark getrübt, im Basalteil etwas — aber wenig — lichter, mit heller, sehr schmaler, undeutlicher Areola; Adern deutlich.

Kopf von den Augen an etwa 156 μ, im ganzen 173 μ lang, an den Augen etwa 173 μ breit; Augendurchmesser etwa 88 μ; Augen grob facettiert, deutlich beborstet; Interocellarborsten mässig (28 - 30 μ) lang, in normaler Lage, Stirnhaare sehr lang; Anteocellarborsten sehr klein, knapp vor der Höhe des vorderen Ocellus, nahe dem Augeninnenrande; Wangen hinter den Augen etwas geschnürt, schwach gewölbt, nach hinten etwas verengt; Scheitelfläche grob-runzelig, Scheitelhinterrand geschwärzt; postokulare Borstenreihe einfach. Maxillarpalpen 22, 13 - 14, 25 μ lang, sehr schlank. Fühler mässig, 337 - 372 μ, lang; Gliederlängen (-breiten): 32 (31), 48 (27 - 28), 74 - 84 (22), 68 - 80 (22), 48 - 56 (19), 64 - 67

(19), 6 - 7 (7), 8 - 10 (6) μ; Borsten auf den Fühlern lang, dunkel, die längste am 3. Glied 44 - 52 μ; 3. und 4. Glied am Ende leicht vasenförmig geschnürt (cf. *Taen. atratus*), das 5. am Ende bisweilen schräg abgestutzt erscheinend, der Stylus sehr kurz; Sinneskegel mässig lang, am 3. Gl. etwa 32 μ, Prothorax 208 - 216 μ breit, 165 - 180 μ lang; die kleinen nach vorn gerichteten Borsten der Vorderecken verhältnismässig sehr gut entwickelt, 28 - 34 μ Hinterecken-borsten sehr lang, gebogen, 108 - 132 μ, das innerste der 3 Paar inneren Postero-marginalborsten mindestens 40 μ lang; Diskalborsten lang, eine laterale vor den Hinterecken 52 μ; Pterothoraxbreite 337 - 363 μ; die inneren Basalborsten des Metascutums sind knapp am Vorderrand gelegen, bis 85 μ lang, die dahinter liegenden, nackten Poren einander äusserst nahe. Flügellänge 1.12 - 1.33 mm; Costa des Vorderflügels mit 30 - 33, Hauptader mit 4 + 3 basalen und 1 + 1 + 1 distalen, Nebenader mit 15 - 18 Borsten; Flügelborsten lang, dunkel; Schuppe mit normaler Borstenzahl (5 + 1); Hintertibien (ausser den Endsporen) innen mit etwa 20 Börstchen, Tibienlänge 264 - 268 μ. Die Poren vor dem Hinterrande des 1. Tergites diesem sehr genähert, nur 4 - 8 μ hievon entfernt, voneinander etwa 36 μ (bei grossen Stücken); 2. Tergit mit 3 lateralen Borsten; 8. Tergit mit vollständigem, mässig langem Kamm; Sternite mit accessorischen Borsten, am 2. Sternit 3, auf den übrigen eine ziemlich regelmässige Querreihe (am 3. etwa 15 Borsten); Borsten am 9. Tergit, apikale B. 1: 104 - 120, B. 2, 3: 140 - 168 μ; B. 1 am 10. Tergit 140 - 145, B. 2: 132 - 148 μ; 9. Tergit 76 - 80 μ, 10. Tergit 80 - 85 μ lang; 10. Tergit etwa bis zur Borstenbasis (oder mehr) gespalten; Legebohrer bis 308 μ lang; totale Körperlänge (normale Dehnung): 1.59 mm.

♂: Das hier beschriebene ♂ stammt nicht vom selben Fundort als die Weibchen, gehört aber zweifellos hierher. Färbung wie beim ♀, jedoch im ganzen etwas lichter; 3. Fühlerglied im Basalteil etwas lichter als im Endteil. Kopf 120 μ lang, 142 μ breit; Augenlänge 70 μ; Fühlerlänge 329 - 337 μ; Glieder-längen (-breiten): 26 - 28 (29), 48 (25), 70 - 72 (21), 60 - 68 (19), 44 (17), 68 - 70 (17 - 19), 6, 8 - 10 μ; die längste Borste am 3. Glied 40 μ; Pronotumlänge 120, Breite 176 μ; Hinterecken-Borsten 78 - 88 μ, laterale 40 μ; Flügel 0.9 mm lang; Costa mit 26 - 27, Hauptader wie beim ♀, Nebenader mit 12 Borsten; Hinter-tibien 200 - 205 μ lang, am Innenrande mit etwa 14 Dörnchen; Schenkel und Schienen deutlich, aber wenig dicht anliegend behaart. Die vorderen Drüsen-felder der Sternite dünner als die hinteren, Masze: 10 (64), 12 (62), 16 (58), 16 (50 - 52), 16 (44) μ; gut entwickelte accessorische Borsten knapp hinter den Drüsenfeldern; die längsten Lateralborsten des 9. Segmentes messen etwa 88 μ; 9. Tergit mit 4 Paar Borsten in einer Querreihe, von denen die mittleren viel länger sind als die äusseren.

Fundort: ♀♀ und rote Larven, Java, G. Lande, 3.100 m, XII.1924, in Blüten von *Vaccinium varingifolium* Miq. (leg. Docters van Leeuwen); ♂, Buitenzorg, 15.V.1924 (leg. H. H. Karny).

Taeniothrips tristis ist durch die lange Prothorax-Beborstung, die dunklen Fühler und den sehr kurzen Stylus mit keiner anderen Art zu verwechslen;

grosse Exemplare sind von Arten der Gruppe des *montivagus* durch das letztere Merkmal und durch den Mangel an accessorischen Borsten der Sternite leicht zu unterscheiden.

Taeniothrips brevistylus spec. nov.
(PRIESNER, Stylops, IV, 1935, p. 129).

Dem *Taen. pallipes* BAGN. ähnlich, aber grösser, mit längeren Borsten, äusserlich auch an *Thrips florum* SCHM. erinnernd, aber viel kräftiger gebaut und nicht etwa eine Form desselben mit 2-gliedrigem Stylus.

♀: Kastanienbraun, mit rötlichem Pigment im Körper; Mittel- und Hinterschenkel dunkel, die erstern an Basis und Spitze, die letzteren am Grunde gelblich, Vorderbeine ganz hellgelb, nur die Schenkel an der konvexen Seite etwas getrübt, alle Tibien und Tarsen hellgelb. Flügel stark getrübt, am Grunde ein wenig lichter, aber noch immer deutlich getrübt, mit länglicher, hyaliner Areola oder einem hyalinen Längswisch an der Stelle. Fühler dunkel, das 3. Glied hellgelb, oben mehr weniger schwach grau getrübt; Borsten dunkel.

Kopfform wie bei *Thrips florum*, Länge 124 - 128, von den Augen an, 144 μ total; Augen länge 84 - 88 μ, Interocellarborsten mässig lang, 24 - 28 μ, an oder etwas innerhalb der Tangente, die sehr kleinen Anteocellarborsten vor der Höhe des 1. Ocellus; postokulare Reihe knapp um die Augen, das innerste Börstchen deutlich, etwa 28 μ oder mehr; Scheitel mit schwärzlicher Hinterrandlinie. Maxillarpalpen 20, 12, 24 μ lang; Fühler etwa 345 μ lang; Gliederlängen (-breiten): 28 (31), 42 - 45 (27), 73 - 76 (22), 71 - 73 (20), 48 - 50 (16), 67 (17), 6 (7), 8 - 9 (6) μ; längste Borste am 3. Glied 42 μ; das 3. Glied am Ende etwas geschnürt, das 4. vasenförmig, Abstand der Sinneskegelbasis von der Gliedspitze aber nur 14 - 16 μ, 4. und 5. Glied mit undeutlichem Subbasalring. Pronotum etwa 144 - 160 μ lang, 208 - 225 μ breit, Hintereckenborsten 92 - 102 μ; die nach vorn gerichtete Vorderecken-Borste 28 μ; Scheibe spärlich mit etwa 10 - 13 Borsten-Paaren besäet; innere Hinterrand-Borsten 2 - 3 Paare; Pterothoraxbreite 285 μ; Länge 295 μ, Flügellänge 882 - 917 μ; Costa mit 5 basalen und 21 - 22 weiteren, Hauptader mit 4 + 3 basalen und 1 + 1 + 1 distalen, Nebenader mit 12 - 15 Borsten; mediodorsales Borstenpaar des Metascutums an der Basis gelegen, 56 - 60 μ lang, die beiden borstenlosen Poren 32 - 40 μ voneinander abstehend und weit vom Hinterrand; Hintertibien ausser den Endsporen mit 15 - 16 hellen Börstchen am Innenrand. Seitenrand des 2. Tergites mit 4 Börstchen, das 1. sehr klein, Sternite mit ziemlich regelmässigen, fast nirgends verdoppelten Querreihen accessorischer Borsten, am 7. Segment deren etwa 5 Paare; 8. Tergit mit zartem, aber vollständigem Kamm; Porus des 8. Tergites nahe den beiden Medianborsten-Paaren; Borsten 1 des 9. Segmentes 100 - 108, B. 2: 124 - 136, B. 3: 120 - 130 μ lang; B. 1 des 10. Segmentes 128 - 132, B. 2: 112 - 116 μ lang; 10. Tergit bis zur Borstenbasis gespalten.

Fundort: Java, G. Gedeh, Tjibodas, ± 1500 m, 2.VII.1925, im Urwalde in Blüten von *Corymbis veratrifolia* RCHB. (Orchidaceae), leg. DOCTERS VAN LEEUWEN.

Taeniothrips fulmeki spec. nov.

♀: Dunkel kastanienbraun, Thorax etwas rötlich, Beine ganz licht, gelb, die Schenkel und Tibien mögen aber bei anderen Exemplaren am Aussenrande getrübt sein; Borsten dunkel; Fühler dunkel, das 3. Glied unten bis zur Hälfte hellgelb, oben nur an der Basis so, im allgemeinen aber auch sonst lichter als das 4., das wie das 5. ganz dunkel ist mit Ausnahme des kleinen hellen Subbasalringes. Flügel an der Basis hell (etwa im basalen Drittel), nur ganz schwach grau getrübt, dann stark getrübt, die Trübung aber gegen die Flügelspitze hin allmählich aufgehellt, so dass diese selbst fast so licht wird wie die Flügelbasis.

Dem *Thrips sumatrensis* etwas ähnlich, aber durchaus nicht etwa eine Form desselben mit 2-gliedrigem Stylus. Kopf breiter als lang, Augen länger als die Wangen, Interocellarborsten mässig lang, 36 - 40 μ, in normaler Lage; Postocellarborsten (innerste Postokularen) etwas kürzer als die vorigen; unsicher ist eine sehr kleine 2. Postocellarborste hinter der ersteren; Maxillarpalpen schlank; Fühler 372 - 380 μ lang; Gliederlängen (-breiten): 28 (?), 36 (29), 80 (24), 70 (23 - 24), 52 (19), 68 (20), 8 (8), 8 - 10 (6) μ; (Breitenmasze lateral). Das 3. und 4. Glied am Ende — aber nur ganz kurz — etwas geschnürt; die längste Borste am 3. Glied 48 μ; Sinneskegel wohl entwickelt, der längste am 6. Glied entspringt etwa in der Gliedmitte, erreicht aber nur das Ende des 7. Gliedes; Stylus kurz, Glieder voneinander sehr wenig verschieden; das 5. Glied auch von der Mitte zum Ende verengt. Pronotum-Scheibe mit etwa 15 Paar Borsten, Vorderecken mit 2 kleinen, nach vorn gerichteten, innerhalb mit vier Paaren nach innen gerichteter Börstchen; Lateralborsten lang, 40 - 44 μ; Hinterecken-Borsten sehr lang, 108 - 120 μ; Hinterrand innerhalb derselben mit 3 Paar Börstchen. Die inneren Borsten der Metascutum-Basis lang, 84 μ; Flügel 1.09 - 1.12 mm lang; Schuppe mit 5 + 1, Costa mit etwa 32, Hauptader mit 4 + 9 basalen und 1 + 1 + 1 distalen Borsten, von denen die erste distale den basalen stark genähert sein kann, Nebenader mit 19 - 20 Borsten. Hintertibien 172 μ lang, innen mit einer Reihe von 10 - 11 Börstchen (ausser den Sporen). 2. Tergit seitlich mit 4 Paar ziemlich langen Borsten, 8. Tergit mit sehr zartem, aber vollständigem Kamm; Sternite mit je einer Querreihe accessorischer Borsten. Legebohrer lang, etwa 476 μ. Borsten am 9. Tergit, B. 1: 116 - 120, B. 2: 160 - 168, B. 3: 144 - 148 μ lang; dorsale 60 μ; B. 1 am 10. Segment 108 - 116 μ; 10. Segment oben 120 - 128 μ lang.

Fundort: S u m a t r a, Medan (S.O.K.), Sibajak, 1212 m, VIII.1923, leg. L. FULMEK.

Ich besitze nur ein einziges, lateral präpariertes Exemplar dieser Species, konnte sie aber deshalb nicht übergehen, da sie durch die angegebenen Merkmale, wenn wiedergefunden, unschwer wiedererkannt werden kann.

Die Beborstung der Flügel erinnert sehr an die von *Thrips sumatrensis; Taeniothrips fulmeki* hat aber bedeutend längere Flügel — viel zahlreichere Nebenaderborsten — und ist auch sonst durch die bedeutendere Grösse — abgesehen von der Färbung — leicht zu unterscheiden; *Taen. vitticornis* KA. ist

nicht zu verwechseln, da viel kleiner und hat viel kürzere und anders angeordnete Borsten der Flügel. In meiner Uebersicht musste ich sie nahe *Taen. minor* BAGN. einreihen, doch hat *fulmeki* mit dieser Art genetisch wenig gemein, da *minor* eher in die *nigricornis*-Verwandtschaft gehört.

Taeniothrips leeuweni spec. nov.

♀: Kopf und Thorax orange, Abdomen kastanienbraun bis schwarzbraun, oder der Thorax mehr oder weniger stark braun getrübt, Kopf und Prothorax lichter als Pterothorax; Ocellen-Pigment rötlich, Schenkel dunkel, die vorderen licht oder mehr weniger getrübt, oft nur am Aussenrande; Vorderschienen gelblich, schwach getrübt, Mittel- und Hinterschienen dunkel, am Ende hellgelb, bisweilen aber im Ganzen nur schwach getrübt; Flügel stark getrübt, an der Basis breit hell (aber nicht vollkommen hyalin), längs der Basalborsten der Hauptader immer etwas getrübt; 1. und 2. Fühlerglied etwa von der Farbe des Prothorax, auch das 4. bis 8. Glied dunkel, das 3. gelblich, mehr weniger deutlich grau getrübt; Borsten am Körper dunkel. Scheitelhinterrandlinie getrübt oder schwärzlich.

Kopf ohne Besonderheit, Länge von den Augen an 140, total etwa 160 μ, Breite an den Augen 172 - 176 μ; Augen normal facettiert, lateral 84 - 88 μ lang, hinter ihnen ein einspringender Winkel, die Wangen von da etwa geradlinig nach hinten verengt, etwas gekerbt, die Querrunzeln des Scheitels daher deutlich; Interocellarborsten 36 - 40 μ lang, in oder etwas ausserhalb der Tangente, postokulare Reihe nahe den Augen, normal, aus k l e i n e n Börstchen bestehend, das innerste von den hinteren Ocellen nur 8 μ entfernt; innerer Abstand der hinteren Ocellen 28 - 30 μ; Mundkegel und Maxillarpalpen schlank, die Glieder der letzteren 31, 11 und 25 μ lang; Fühlergliederlängen (-breiten) vom 2. an: 48 (?), 68 - 74 (24 - 25), 68 - 72 (21 - 22), 48 - 52 (17), 60 - 64 (18 - 19), 8 - 9 (75 - 8), 10 - 12 (6) μ; Sinneskegel am 3. und 4. Glied gut entwickelt, das 3. und 4. Glied am Ende etwas geschnürt, das 5. knapp vor der Spitze etwas verengt; Stylus kurz. Prothorax 185 μ lang, 208 - 224 μ breit, seine Seiten nach hinten nicht erweitert; Scheibenborsten mässig dicht, wenig hervortretend, da sie nicht sehr dunkel sind; Hintereckenborsten, äussere 68 - 80, innere 84 - 88 μ lang; innerhalb stehen 3 Paar posteromarginale, deren innerste etwa 28 μ lang; Mesoscutum dicht querwellig, Metascutum am Vorderrand ebenso, am Seitenrand schräg längsstreifig, in der Mitte deutlich genetzt; Basalborsten des Metascutums 52 - 55 μ lang; Flügellänge 780 - 882 μ; Flügel mässig breit, Schuppe mit 1 + 5, Costa mit 30 - 32, Hauptader mit 4 (5) + 3 basalen und 1 + 1 + 1 distalen Borsten, Nebenader mit 15 - 16 Borsten. Sternite mit accessorischen Borsten; das Microporen-Paar am 1. Tergit dem Hinterrande sehr nahe (bei d. Type 44 μ), einander etwas näher oder so weit entfernt als das Microseten-Paar; 8. Tergit mit Kamm, der an den Seiten deutlich entwickelt, in der Mitte aber unterbrochen ist; Microporen am 8. Tergit in oder fast in der Höhe der beiden Dorsalborsten; B. 1 am 9. Segment 120 - 128, B. 2: 144 - 150 μ lang, B. 1 am 10. Segment 140, B. 2: 105 μ lang; 10. Segment schlank,

lang-konisch, etwa 96 - 100 μ lang, etwa bis zur Borstenbasis gespalten. Legebohrer 345 μ lang. — ♂ unbekannt.

Diese Art ist dem *pavettae, tristis* und *brevistylus* nahe, von ersterer Art aber durch die normalen Augenfacetten, den kräftigeren Körper und die lichtere Färbung des 3. Fühlergliedes und der Flügel, ferner das viel schlankere und längere 10. Abdominalsegment verschieden; *tristis* ist eine viel robustere Art, mit längeren, fast ganz dunklen Flügeln und ganz dunklen Antennen, längeren Borsten u.s.w.; von *brevistylus*, dem sie am nächsten kommt, unterscheidet sie sich durch die kürzeren Borsten des Pronotums, die kürzeren Fühler und die längeren Endsegmente des Abdomens, ferner den in der Mitte unvollständigem Kamm des 8. Tergites.

Fundort: Malaya, Singapore, 20.IX.1920, in Blüten einer *Rubiacea* (No. 21), leg. W. DOCTERS VAN LEEUWEN.

Taeniothrips hospes (KARNY).

Von dieser Art ist nur 1 Exemplar bekannt geworden, das überdies beim Umpräparieren die Fühler verlor. Zur Originalbeschreibung gebe ich einige Ergänzungen.

Es ist noch zu erkennen, dass der ganze Körper getrübt war, der Pterothorax am lichtesten. Flügel stark und gleichmässig getrübt, an der Basis nicht aufgehellt.

Interocellarborsten gekrümmt, 32 - 36 μ lang, etwas innerhalb, nahe am Vorderrand der hinteren Ocellen gelegen; die postokulare Borstenreihe sehr nahe den Augen, so dass die innerste (postocellare) nur 5 μ vom hinteren Ocellus absteht. Scheibenborsten des Pronotums spärlich, aber ziemlich lang, beide Hintereckenborsten 48 μ lang, innerhalb derselben sind 2 Paar Börstchen vorhanden; Pronotum-Länge 96 μ. Behaarung der schlanken Beine deutlich etwas gehoben. Basalborsten des Metascutums 32 - 36 μ; Flügellänge 740 μ; Flügel schmal, Hauptader mit 4 (3) + 3 basalen und 2 distalen, Nebenader mit 14 - 15 Borsten, Costa mit etwa 30. Borste 1 am 9. Segment 48 - 52 μ, B. 3: 76 μ lang; B. 2 am 10. Segment etwa 64 μ; diese Borsten ziemlich licht, dünn. Der Kamm am 8. Tergit scheint zu fehlen. Legebohrer etwa 228 μ, Hinterschienen 152 - 156 μ. Sternite ohne accessorische Borsten.

Lefroyothrips subgen. nov.

Postokularborstenreihe stark winkelig, sodass hinter dem hinteren Ocellus 2 kleine Postokularen stehen; Scheitel hinter der Börstchenreihe mit besonders starken Querrunzeln, sodass der Kopf an den Seiten stark gekerbt erscheint; 3. und 4. Fühlerglied am Ende stark geschnürt; Flügel abwechselnd verwaschen dunkler und lichter, mit verhältnismässig kurzen Costalborsten und Längsaderborsten, auch der Prothorax mit im Verhältnis zur Körpergrösse kurzen Borsten; 3 Paar innere Hinterrandborsten des Pronotums. Mehr als 10 Börstchen an der Innenseite der Hintertibien. 9. Tergit des ♂ mit 3 Paar Dornen, Sternite mit Drüsenfeldern.

Typ. Subgen. *Taeniothrips* (*Lefroyothrips*) *lefroyi* BAGNALL.

Taeniothrips (Lefroyothrips) cuscutae spec. nov.

♀: Hellgelb bis orange, Wangen leicht getrübt, leichte graue Schattierungen am Thorax, Abdominal-Tergite 1 - 2 - 8 der Quere nach breit braun getrübt, die Seitenränder bleiben hell; 10. Segment wenigstens an den Seiten deutlich getrübt; Flügel unregelmässig mehr weniger blassgrau getrübt, schmutzig, mit 3 schwachen Verdunkelungen: etwa in der Gegend der letzten Basalborsten, der 1. Distalborste und der 2. Distalborste; F ü h l e r d u n k e l, alle Glieder stark graubraun getrübt, aber das 1. und 3. meist etwas lichter als die übrigen, das 3. am äussersten Grunde, und am Ende aufgehellt, das 4. am Grunde lichter (aber meist nicht rein hellgelb), das 5. am Grunde unscharf abgegrenzt licht; die Fühler sind viel dunkler als bei *lefroyi;* Borsten dunkel; Beine hellgelb bis orange, die Schenkel und Schienen aussen zuweilen g a n z l e i c h t getrübt; Ocellen hellrot.

Kopf von den Augen an etwa 180, total 200 μ lang, an den Augen 188, hinten 196 μ breit; seitlicher Augendurchmesser trotz der Grösse des Tieres seitlich etwa nur 80 μ; vor dem vorderen Ocellus stehen zwei sehr kleine Anteocellaren hintereinander, seitlich vor dem vorderen Ocellus, an den Seiten der Netzaugen eine Borste jederseits; Interocellarborsten klein, etwa nur 20 - 25 μ lang, an oder etwas innerhalb der Tangente gelegen; die postokulare Querreihe beschreibt einen sehr hohen Bogen, sodass die beiden innersten Börtschen derselben h i n t e r e i n a n d e r zu liegen kommen, also von 2 postocellaren Borsten gesprochen werden kann; 1 - 2 Querrillen des Scheitels sind besonders stark, sodass sie an den Seiten als eckige Kerbzähne vorspringen; Fühler nur 390 - 400 μ lang; Gliederlängen (-breiten): 28 - 32 (36), 54 - 56 (32), 84 (26), 74 - 78 (24 - 25), 54 - 56 (23), 56 - 64 (23), 10 - 11 (8), 16 (5 - 6) μ; Borsten am 3. und 4. Glied dunkel, die beiden Glieder am Ende deutlich vasenförmig geschnürt, gabelige Sinneskegel gut entwickelt, spitzig, das 5. Glied im Endviertel fast eckig verengt, am Grunde etwas geschnürt; die beiden längeren Sinneskegel des 6. Gliedes mässig lang, nahe dem Glied-Ende eingelenkt; Stylus mässig lang, Pronotum etwa 155 μ lang, 240 - 250 μ breit, viel schmäler als der Pterothorax (363 μ), Hinterecken-Borsten starr, dick, 56 - 72 μ lang, die inneren etwas länger als die äusseren; Vorderrand mit 4 - 5 Paar Börstchen, Schreibe mit 17 - 18 Paar, innerhalb der Hintereckenborsten stehen gewöhnlich 3 Paar kleine Börstchen. Die inneren Basalborsten des Metascutums etwa 72 μ lang; Flügellänge etwa 1.21 mm; Costa mit über 40 m ä s s i g langen Borsten, Hauptader mit 4 (5) + 3 (4) basalen und 1 + 2 distalen, Nebenader mit 14 - 18 Borsten; Adern deutlich; Hintertibien innen mit 12 - 14 hellen Härchen. Microporen des 1. Tergites von einander etwa 40 μ entfernt, die Microsetae einander näher (24 μ), die ersteren vom Hinterrande etwas abstehend (18 - 20 μ); 2. Tergit lateral mit nur 3 Borsten; Sternite ohne accessorische Borsten; die Microporen des 8. Tergites liegen etwa in der Höhe der beiden Dorsalborsten; Kamm lang, vollständig, dicht. Borsten am 9. Segment, dorsale 88, B. 1 des Hinterrandes 168 - 172, B. 2: 184 - 192, B. 3: 175 - 180 μ; Borsten 1 des 10. Segmentes 160 μ, B. 2: 145 μ lang; 10. Tergit bis über die Borstenbasis hinaus gespalten; Legebohrer etwa 363 μ lang.

♂: Lichter als das ♀, kleiner; hellgelb, die Trübungen weniger deutlich; Fühler lichter, 1. - 3. Glied dunkelgelb bis orange, mit Ausnahme der Basalhälfte des 2. und 3. schwach grau getrübt, das 4. im Basaldrittel (oder mehr) gelb, das 5. in der Grundhälfte hellgelb; die Fühler können aber noch lichter sein, fast ganz hellgelb und vom Ende des 5. Gliedes an leicht getrübt; die Flügelfleckung ganz undeutlich oder nicht mehr erkennbar.

Fühlergliederlängen, vom 2. Gl. an: 52, 78 - 88, 74 - 84, 52 - 58, 56 - 58, 10, 14 - 16 μ; äussere Hinterecken-Borsten des Prothorax 60 μ; Sternite 3 - 7 mit sehr kleinen, rundlichen Drüsenfeldern, die der hellen Farbe halber schwer sichtbar sind; ihre Breiten: 24 - 40, 20 - 36, 16 - 30, 16 - 32 μ; 9. Tergit mit 3 Paar dunklen Dornen, seitlich mit einer etwa 44 - 52 μ langen Dornborste; von den 3 Paar Dornen steht 1 Paar vor den übrigen, die in einem nach vorn offenen Bogen angeordnet sind.

Diese Art ist dem *lefroyi* äusserst ähnlich, nur sind bei den Weibchen des letzteren die Fühler länger und dünner, vom 4. Gliede an z.B.: 88 - 94, 68 - 70, 72, 12, 18 μ, oder grosse Stücke (v. 3. an): 108 - 112, 104 - 112, 72 - 78, 68 - 76, 12, 20 μ; ihre Färbung ist schärfer abgesetzt, das 5. Glied in der Grundhälfte (oder mehr) hellgelb, in der Endhälfte schwärzlich oder braun, ebenso das 4. Glied am Grunde scharf abgesetzt hellgelb; die Flügel sind bei ausgefärbten Stücken des *lefroyi* deutlicher gefleckt. Auf jeden Fall sind auch die Färbungsunterschiede bei ausgefärbten wie bei ganz verblassten Stücken (Typen Bagnalls) gut zu erkennen. Im männlichen Geschlechte ist *lefroyi* in den Fühlermassen ähnlich (nur die Endglieder etwas länger), aber die Drüsenfelder der Sternite sind bei *lefroyi* viel breiter (4. - 7. Sgm.: 96, 100, 84, 76), hier also z.B. am 4. Segment etwa 96, bei *cuscutae* 20 - 36 μ breit.

Fundort: Java, Goen. Smeroe, ± 2700 m, 22.IX.1925, in Blüten von *Cuscuta* (leg. W. Docters van Leeuwen); Pangrango, 3000 m, 1923, no. 58 (leg. H. H. Karny); Pangrango, ± 2400 m, 3.II.1920, in Blüten von *Viburnum coriaceum* (leg. W. Docters van Leeuwen). — India, W. Himalaya, M. Bhowali Kumaou, in *Clematis*-Blüten (leg. A. D. Imms; 1 Präparat *lefroyi* aus der Sammlung Bagnall, Reg. 210).

T. lefroyi Bagn. liegt von folgenden neuen Fundorten vor: Sumatra, Sibajak, 1212 m, VIII.1923 (leg. L. Fulmek). — Java, Pangrango, 3000 m, 1923, (leg. H. H. Karny, no. 58; 1 ♀ zusammen mit *cuscutae*).

Taeniothrips (Lefroyothrips) theiphilus spec. nov.

♀: Hellgelb bis hellorange, ohne Spur von Trübungen auf den Tergiten (auch bei völlig ausgefärbten Stücken) oder sonst am Körper, äusserste Spitze des 10. Abdominalsegmentes leicht verdunkelt; Beine ganz licht, wie der Körper; Ocellen karminrot, Borsten am Körper dunkel, seltener nur schwach getrübt. Flügel licht, die für *lefroyi* charakteristischen Trübungen nur ganz schwach angedeutet oder fehlend. Fühlerfärbung: 1. und 3. Glied hellgelb, 2. deutlich getrübt, 4. schwarzbraun, etwa im Grunddrittel hellgelb, 5. hellgelb,

im Enddrittel oder in der Endhälfte dunkel, 6. - 8. Glied ganz dunkel; die Fühlertrübungen sind scharf abgegrenzt.

Körperform und Augen, Beborstung in ihrer Anordnung, wie bei *cuscutae*. Unterschieden ist diese Form durch die Färbung der Fühler, die vollkommen ungefleckte und ungetrübte Körperfärbung, ferner besonders durch die viel kürzeren Hinterecken-Borsten des Prothorax, die bei allen Exemplaren (mit Ausnahme eines 60 μ) 32 - 52 μ messen, mehr weniger getrübt und kräftig sind. Die Fühler ähneln in der Färbung mehr denen des *lefroyi*, aber das 3. Glied ist ganz licht, ausserdem sind die Fühler viel kürzer und gedrungener, die Pronotum-Borsten viel kürzer als beim typischen *lefroyi*.

Masze in μ: Kopfbreite 188 - 192, Pronotumbreite 225 - 235; Pterothoraxbreite 310 - 337; Fühlerlänge 372 - 380; Gliederlängen (-breiten): 32 - 36, 52 - 56 (32), 72 - 80 (28), 74 - 80 (24), 56 - 60 (20), 56 - 60 (20), 9 - 10 (11), 16 (8); Flügellänge 900 - 934.

♂: Das Männchen ist hellgelb, mit schwarzen Augen und roten Ocellen, w e n i g getrübten Borsten des Vorderkörpers, aber dunklen Borsten des Abdomenendes und mit 6 Stacheln des 9. Tergites; diese Stacheln sind etwa wie bei *lefroyi* angeordnet; bei den meisten Exemplaren sind die Fühler fast ganz hellgelb, nur die Endhälfte des 6. Gliedes und der Stylus leicht getrübt, ganz dunkle Stücke haben auch das 4. und 5. Fühlerglied am äussersten Ende getrübt. Der Seitenstachel des 9. Tergites ist 40 - 52 μ lang, die lange Lateralborste misst 140 μ während beim Männchen des *lefroyi* die Hintereckenborsten des Prothorax 52 - 60 μ lang sind, messen sie hier nur 32 - 40 μ. Fühlergliederlängen vom 2. an: 36, 72, 68, 56, 54, 8, 14 μ. Die Drüsenfelder auf den Sterniten sind dünn, sehr in die Breite gezogen, ganz verschieden von jenen des *cuscutae*, ähnlich denen von *lefroyi;* bei den meisten Exemplaren sind sie schwer zu erkennen, bei einem Stück gelang es mir aber doch, sie genau zu messen, ihre Breite schwankt vom 3. - 7. Sternit nur von 64 bis 66 μ.

Fundort: J a v a, Buitenzorg, Sept. 1921, von Thee-Blüten (leg. W. C. v. HEURN). *Physothrips pictus* HOOD aus Süd-Nigerien gehört gleichfalls zu *Lefroyothrips*.

Mecothrips KARNY.
(Treubia, I, 4, 1921, p. 285).

Bei der Aufstellung der Gattung *Mecothrips*, die zwar konvergente doch heterogene Elemente umfasst, hat sich KARNY offenbar durch die Körperform beeinflussen lassen, die die beiden von ihm beschriebenen Arten (*nomoceras* und *anomoceras*) besitzen, die beide zusammen in eingerollten Blättern von *Amomum coccineum* leben (l.c. p. 284).

Die eine der beiden Arten, *nomoceras,* kann ganz gut bei *Taeniothrips* bleiben und stimmt in den wesentlichen Merkmalen mit anderen Arten überein; die Art *anomoceras* hingegen hat in allen Exemplaren (mit Ausnahme eines, bei dem der eine Fühler monströs verkürzt ist, der andere 2-teiliges 7. Glied besitzt, l.c. fig. 14) 7-gliedrige Fühler. *M. anomoceras* ähnelt also sehr lang-

gestreckten, langköpfigen Vertretern der Gattung *Thrips* L., kann aber wegen der Stellung der Kopfborsten sehr wohl von *Thrips* getrennt bleiben, da ja auch z.B. *Stenothrips* Uz. hauptsächlich durch die Kopfbeborstung (und Kopfform) charakterisiert ist (vgl. SPEYER, Proc. R. Ent. Soc. London, Ser. B., vol. 6, pt. 2, 1937, p. 38 - 39).

Da KARNY keinen Gattungstypus bestimmte, trage ich dies hiemit nach und lege *M. anomoceras* als Gattungtypus fest, da sie nach Ueberführung der Art *nomoceras* zu *Taeniothrips* als einzige übrigbleibt.

Die Gattungs-Beschreibung wäre wie folgt:

„Fühler schlank, 7-gliedrig (Stylus 1-gliedrig, selten monströs 2-gliedrig); Körper schlank, Kopf lang, Augen vortretend, breiter als die wenig gewölbten Wangen; Sinneskegel am 3. und 4. Glied dünn, gabelig; Interocellarborsten fehlen, d.h. sie sind soweit nach aussen gerückt, dass sie als 2. Paar Anteocellarborsten (nahe dem Innenrande der Augen) figurieren, das sehr kräftig entwickelt ist; Postocellarreihe einfach, bogenförmig; Mundkegel kurz und breit, Maxillartaster 3-gliedrig (beim ♂ die Trennungslinie zwischen 2. und 3. Glied bisweilen undeutlich); Hinterecken des Pronotums jederseits mit 2 kräftigen Borsten; Metascutum oben mitten fein gerieft, nicht genetzt; Flügel lang, normal; Beborstung d. Generotype: 3 + 4 basale, 1 + 2 distale Borsten d. Hauptader). Sternite bei beiden Geschlechtern mit accessorischen Borsten; Abdominal-Tergite 5 - 8 oben an den Seiten beim Weibchen mit einigen Querrillen abstehender Microsetulae (Lateralkamm); Kamm am 8. Tergit nur an den Seiten entwickelt. ♂ mit Drüsenfeldern.

Mecothrips anomoceras KARNY.
(Treubia, I, 4, p. 289; figs. 8, 13, 14).

♀: Braunschwarz, alle Schenkel und Tibien dunkel, die Vordertibien wolkig aufgehellt, Tarsen hellgelb; 1. und 2. Fühlerglied schwarzbraun, 3. und 4. hellgelb, 5. am äussersten Ende ganz schwach hell graubraun getrübt, 6. im Grunddrittel oder in der Grundhälfte hellgelb, in der Endhälfte lichtbraun, 7. Glied dunkel. Flügel stark getrübt, an der Basis stark aufgehellt, aber nicht hyalin; Adern sehr deutlich.

Kopflänge von den Augen an 168 - 172, total 198 μ, Breite an den Augen 186, hinten nur 168 μ; Augen stark vorgewölbt, Facetten grob, lateraler Augendurchmesser 85 μ; Wangen kaum gewölbt, hinter den Augen fast geradlinig, von der Wangenmitte aber nach hinten verengt, seitlich gekerbt, rauh; Kopf etwas nach vorn vorgezogen; Mundkegel kurz, breit-abgerundet; Maxillarpalpen etwa 16, 12, 18 μ lang; zwei hintereinander, an den Innenrändern der Augen liegende Anteocellar-Borstenpaare, von denen das vordere etwa 40 μ, das hintere 64 - 68 μ misst; Interocellarborsten fehlen; postokulare Reihe einfach, die äussersten Börstchen von den Augen ziemlich abgerückt; Fühler dünn und langgestreckt; Gliederlängen (-breiten): 28 (36), 44 (28), 84 (20), 68 (18 - 19), 52 (18), 46 - 48 (18), 24 (7 - 8) μ; das 3. Glied deutlich länger als das 4.; Sinneskegel lang, sehr dünn; Prothorax etwa 160 - 165 μ lang, 215 μ

breit, Hintereckenborsten 60 - 68 μ lang, dunkel, innerhalb derselben stehen 2 paar Börstchen. Pterothorax etwa 380 - 400 μ lang, 330 μ breit; Hintertibien innen mit einer Reihe von etwa 11 verhältnismässig langen Börstchen, die Endsporen lang, der längste 48 μ, etwas länger als die beiden anderen; mittlere Basalborsten des Metascutums nicht an der Basis, sondern näher der Mitte gelegen; Flügellänge 1.107 - 1.125 mm; Costa mit etwa 30 (gegen das Flügelende sehr dünnen) Borsten, Hauptader mit 2 (3) + 3 basalen und 1 + 2 distalen, Nebenader mit 13 - 15 Borsten; die 2. der zwei basalen Hauptaderborsten sehr lang, viel länger als alle übrigen. Sternite mit 1 lockeren Querreihe accessorischer Borsten; 8. Tergit am Hinterrande ohne Kamm, in der Mitte ganz flach etwas eingebuchtet, die dorsalen Microporen stehen hinter den inneren Dorsalborsten; Legebohrer etwa 300 μ lang; B. 2 des 9. Segmentes etwa 140, B. 3 108 μ lang; 10. Segment verhältnismässig kurz, nur bis zur Borstenbasis fein gespalten.

♂: Ebenfalls dunkel, schlank, in der Färbung sowohl wie in der Struktur mit dem Weibchen übereinstimmend; 3. bis 7. Sternit mit je einer Queren, hantelförmigen Vertiefung, von beispielsweise folgenden Dimensionen: 14 (104), 16 (96), 16 (94), 18 (82), 20 (78 - 80) μ; an den Seiten der Drüsenfelder steht je eine accessorische Borste, am Hinterrande der Felder 1 - 2 Paare (die am 3. und 4. Segment fehlen können), am 7. können drei Paare vorhanden sein. 9. Tergit hinter dem Microporenpaar (28 μ voneinander getrennt) mit 4 kleinen, kräftigen Börstchen; Hintereckenborste des 9. Segmentes lang, dünn, 84 - 88 μ.

Fundort: Java, Tjibodas, 13.VIII.1920, in jungen, noch gerollten Blättern von *Amomum coccineum* (W. Docters van Leeuwen).

Pteridothrips gen. nov.

Fühler 8-gliedrig, sehr schlank, mit dünnen Endgliedern und sehr langen Sinneskegeln. Kopf quer, vorn nicht vorgezogen; Mundkegel kurz, Maxillartaster 2- oder undeutlich 3-gliedrig; Pronotum stark quer, mit sehr scharfen (von der Seite gesehen erhabenen) konfluierenden Querwellen; 1 lange, gebogene, zum Ende erweiterte, abgeflachte und gekeulte Hintereckenborste jederseits; Pterothorax mässig lang, Flügel schmal, säbelförmig gekrümmt, Nebenader mit zahlreichen Borsten; Abdominalsegmente stark quer, Cuticula ohne Microsetulae, Borsten am 9. Segment mässig lang, 10. Segment nicht gespalten. Beine einfach, Tibien zum Ende ziemlich erweitert.

Typ. gen. *Physothrips pteridicola* Karny.

Diese Gattung steht durch zahlreiche Merkmale fast isoliert; sie erinnert habituell an *Sericothrips*, ist aber damit nicht näher verwandt. Sie hat auch keine näheren Beziehungen zu den Gattungen mit keulig verdickten und gefransten Borsten, wie *Corynothrips* Will., *Rhabdothrips* Hd., *Coremothrips* Hd. Sie ist vielleicht von *Dichromothrips* und *Orchidothrips* genetisch nicht weit entfernt.

Pteridothrips pteridicola (KARNY).

1914. *Physothrips pteridicola,* KARNY, Zeit. wiss. Ins. Biol., p. 368; 1915, p. 34.
1926. *Taeniothrips pteridicola,* PRIESNER, Treubia, VIII, Suppl., p. 66.

♀: Kopf, Prothorax, Fühler und Abdomen mehr oder weniger licht braun, Pterothorax lichter, so wie die Beine gelbbraun, gleichmässig getrübt; es können dunklere Exemplare vorkommen. An den Fühlern ist der Subbasalring des 4. und 5. Gliedes und der verdoppelte Basalring des 3. licht; die meisten Körperborsten leicht getrübt; die Flügel sind dort, wo sie dem Pterothorax anliegen, also etwa im basalen Viertel, licht, sonst stark graubraun getrübt; die Hinterflügel haben eine dicke, dunkle Längsader, und sind ausserdem an der Spitze angeraucht.

Kopf (Länge 72, total 85 µ) stark quer, Augen gross, mit grossen Facetten und einzelnen, ziemlich langen Härchen dazwischen, aber seitlich nicht vorragend; Schrägdurchmesser 65 µ; Ocellen deutlich, einander sehr genähert, die hinteren innen nur 8 µ von einander entfernt; Interocellarborsten gut entwickelt, gekrümmt, zwischen den hinteren Ocellen gelegen, einander sehr (3 µ) nahe; 1 Paar deutliche Anteocellar-Borsten vor dem 1. Ocellus; die postoculare Querreihe spärlich, sehr knapp hinter den Augen, das innerste Börstchen dicht hinter den hinteren Ocellen, nach innen gerichtet; Scheitelrunzeln stark konfluierend, fein aber scharf; Fühlergliederlängen (-breiten): 17 - 20 (25), 31 (25), 50 - 52 (14 - 15), 52 (14 - 15), 41 - 42 (13 - 14), 48 - 49 (12), 11 (4.5 - 5), 14 - 15 (3) µ; Borsten auf den Fühlern lang, dünn, das 3. Glied am Grunde doppelt abgesetzt, dieser Doppelstiel 13 µ lang, der basale Teil hievon mit einer feinen Ringleiste; 3. Gl. vor dem Ende ganz leicht geschnürt, das 4. länger erscheinend, da es nicht gestielt ist, am Ende ganz leicht vasenförmig eingezogen; Sinneskegel sehr lang und sehr dünn, am 4. Glied 39 - 42 µ; das 5. Glied von der Mitte zum Ende leicht verengt, das 6. sehr schlank, vor dem Grunde am breitesten, am Grunde plötzlich zusammengezogen; Stylus sehr schlank. Beine schlank, Hintertibien innen ausser den Endsporen mit nur 4 Börstchen; Schenkel und Schienen mit nicht ganz anliegenden, gebogenen Härchen deutlich belegt, Tarsen kurz. Pronotum stark quer, 84 - 88 µ lang, 175 µ (etwas gedrückt) breit; vorder Hälfte mit anastomosierenden Querriefen, die fein aber sehr scharf sind. sodass sie — von der Seite gesehen — als Rillen vorspringen; auf der hinteren Hälfte ist das Pronotum unscharf und weniger dicht wellig, mit einer leichten Beule jederseits; Scheibenborsten verhältnismässig lang, gekrümmt, meist nach innen gerichtet; der Vorderrand hat nur an den Vorderecken eine kleine Borste, sonst stehen alle Börstchen etwas vom Rande abgerückt, es sind nur 13 - 14 Paar Scheibenbörstchen vorhanden, die längste von ihnen, 34 - 36 µ, ist eine sublaterale; innerhalb der Hinterecken steht nur 1 lange Borste jederseits, die gebogen, dick, gegen das Ende schmal spatel- oder löffelförmig erweitert ist; ausserhalb derselben steht eine kleine Borste; innere Posteromarginalen sind nur 2 Paar vorhanden, von denen das innerste stark gekrümmt, 34 - 36 µ misst; die beiden Borstenpaare des Metascutums sind vom Vorderrande abgerückt, besonders die inneren, die 30 - 34 µ messen; oben eine sehr feine, undeutliche

Netzskulptur. Flügel sehr charakteristisch säbelförmig gekrümmt, nur 536 - 555 μ lang, zugespitzt, schmal; Costa an der Basis — im lichten Teil — sehr spärlich beborstet, mit nur 2 - 3 Borsten, im dunklen Teil mit 15 - 16 Borsten; Hauptader mit 3 (4) + 3 basalen (die ersteren licht, die letzteren dunkel und 0 + 2 oder 1 + 2 distalen Borsten; Nebenader mit 10 - 11 Borsten; Abdominalsegmente stark quer, Sternite ohne accessorische Borsten, 8. Tergit ohne Kamm, die Microporen hinter den zarten Dorsalborsten gelegen; Dorsalborsten am 9. Segment kurz, etwa 20 μ, Hinterrandborsten mässig lang, 48 - 52, am Ende etwas gebogen, B. 3 gerade, haarartig, 62 - 67 μ; Borsten am 10. Segment 42 - 48 μ; Legebohrer 176 - 184 μ. Cuticula des Abdomens ohne Microsetulae. 1 Paar Microsetae des 1. Tergites nahe der Basis, Poren nicht erkennbar.

Fundort: J a v a, Moeria-Gebirge, ± 300 m, 3.X.1912, in Blattgallen an *Polypodium pteropus* (leg. W. DOCTERS VAN LEEUWEN).

Eugeniothrips borneensis spec. nov.

♀: Dunkelbraun, Beine dunkel, die Tibien gegen das Ende etwas aufgehellt, Tarsen hell graugelb; Fühler ganz dunkel, nur die Stellen, wo die mächtigen Sinnestrichome eingelenkt sind, erscheinen etwas lichter; Borsten am Körper dunkel, Flügel stark getrübt, an der Basis starkaufgehellt, aber nicht völlig hyalin.

Kopf ziemlich lang, von den Augen an 136, total 148 - 152 μ lang, an den Augen 152 - 156 μ, an den Schläfen 152 μ breit; Kopf hinter den Augen deutlich etwas geschnürt, Wangen etwas gewölbt, Augen (Länge 76 μ) grob facettiert; Scheitel mit konfluierenden Querrunzeln, die seitlich als Kerbung erscheinen; Interocellarborsten klein aber deutlich, in der Tangente gelegen, die sehr kleinen Postocularen in einem flachen Bogen um die Augen herum, den Ocellen genähert; Anteocellarborsten nahe dem Innenrande der Augen gelegen, in der Höhe des Vorderrandes des vorderen Ocellus; Kopf vorn kaum vorgezogen; Mundkegel ziemlich schmal, 2. Glied der Maxillarpalpen 7, 3. Glied 20 - 24 μ lang. Fühler mässig lang, etwa 390 μ; Gliederlängen (-breiten): 28 - 30 (31), 44 - 48 (29), 84 - 86 (27 - 28), 88 (27), 52 (18), 58 (17), 10 (8), 12 - 14 (6) μ; die haarförmigen Sinneskegel des 6. Gliedes liegen im distalen Drittel oder Viertel, keiner entspringt nahe der Basis; das 3. und 4. Glied am Ende geschnürt aber nicht lang halsförmig ausgezogen, die Gabeltrichome am 3. und 4. Glied sehr lang, am 3. ungefähr 68 μ; das 5. Glied wie das 4. mit weisslichem Basalring, das 5. am Ende wenig verengt, 6. kurz, am Grunde ziemlich breit an das 5. angeschlossen; Stylus kurz; das 3. und 4. Glied mit deutlichen, dunklen Borsten. Pronotum 124 μ lang, 204 μ breit; Scheibe ziemlich reichlich mit kleinen Börstchen besetzt, so dass der Vorderrand 5 Paare erkennen lässt; nur 1 Paar (das innere) der Hintereckenborsten vorhanden, nur 44 - 50 μ lang, kräftig; innerhalb der Hintereckenborsten sind z w e i Paare kleiner, anliegender Börstchen, ausserhalb der ersteren ebenfalls zwei Paare, von denen das äussere dem 2. Hintereckenborstenpaar entspricht, das hier reduziert ist; Pronotumfläche und Mesoscutum schwach querwellig. Beine ohne Besonderheit, Hintertibien innen gegen das Ende mit

einer Reihe von 9 - 10 Dörnchen; Pterothoraxbreite 295 μ, Länge bis zur Basis der Hinterhüften 310 μ; Flügel 917 - 952 μ lang, ziemlich schmal, mit an der Basis des Flügels ziemlich kurzen, an seinem Ende viel längeren Borsten; Hauptader mit 4 + 3 + 3 (oder 4 + 8) basalen und 1 + 2 (weit voneinander entfernten) distalen Borsten, Nebenader mit 15 - 17 Borsten, Costa mit etwa 30 Borsten. Abdominalsternite ohne accessorische Borsten, 8. Tergit mit sehr langem und dichtem, regelmässigem Kamm, dessen Elemente bis 36 μ messen; Borsten am 9. Segment, dorsale etwa 65, B. 1 der Hinterrandreihe 76 - 80, B. 2: 120 - 125, B. 3: 112, B. 2 am 10. Segment 120 μ lang. 10. Segment oben nicht gespalten. Legebohrer 240 - 245 μ lang. — Körperlänge (gedehnt): 1.59 - 1.6 mm.

Fundort: Borneo, Mt. Murud, 6000′, in der grossen, braunen Blüte einer Orchidee (leg. E. MJÖBERG).

Smeringothrips gen. nov.

Fühler 8-gliedrig, Stylus 2-gliedrig; Trichome am 3. und 4. Glied gabelig, lang; 6. Fühlerglied mit 3 Sinneskegeln, einem kurzen und zwei langen, dünnen, nadelförmigen, welch letztere fast die Hälfte ihrer Länge an das Glied angewachsen sind, sodass zwei helle, linienförmige Sinnes-Areolae sichtbar werden: Kopf quer, vorn nicht vorgezogen; Maxillarpalpen 2-gliedrig. Kopfoberfläche glatt, nicht genetzt. Körper ohne Microsetulae. Prothorax mit 1 langen, inneren Vorderrandborste jederseits, und kurzen äusseren Borsten, Hinterecken mit 2 langen Borsten. Flügel normal, mit wenig deutlichen Adern, doch reichlich beborsteter Nebenader. Abdomen und Beine ohne Besonderheit, Borsten kräftig.

Typ. gen. *Smeringothrips salaciae* spec. nov.

Nahe *Taeniothrips* und *Diarthrothrips;* von ersterer Gattung durch die deutlich 2-gliedrigen Maxillarpalpen, von beiden durch die langen inneren Vorderrandborsten des Pronotums und die anliegenden Sinneskegel des 6. Gliedes verschieden. Bei *Ayyaria* KARNY (= *Bussothrips* MOULT., *Parafrankliniella* KUROSAWA (nec PRIESNER)) sind die Borsten der Nebenader spärlich, das 6. Fühlerglied ist wie bei vielen *Taeniothrips*-Arten gebaut, das 9. Abdominalsegment ist lang-kegelig und die Hauptader der gebänderten Flügel ist mit der Costa verschmolzen, die Seiten des Abdomens haben z.T. Netzstruktur.

Smeringothrips salaciae spec. nov.

1915. *Physothrips ulmifoliorum* KARNY (partim; nec HAL., nec UZEL). Zeit. wiss. Ins. Biol. 11, 1 - 2, p. 35.

1926. *Physothrips ulmifoliorum* DOCTERS VAN LEEUWEN, Zoocecidia Netherlands East Ind., p. 330 (no. 21010).

♀: Hellgelb, gut ausgefärbte Stücke vielleicht mit leichten Trübungen am Kopf, Thorax und Dorsum des Abdomens; die beiden vorliegenden Stücke zeigen diese nur schwach, wohl aber ist der Vorderrand der Abdominaltergite braun liniiert (*Thrips tabaci*-Zeichnung); Flügel ziemlich licht, mögen aber bei ausgefärbten Stücken leicht getrübt sein; Körperborsten stark getrübt; Fühler ganz

dunkel, mehr weniger hell graubraun, das 3. Glied am Grundstiel licht, das 4. und 5. mit hellem Subbasalring, das 1. Fühlerglied g a n z l i c h t oder nur ganz schwach getrübt.

Kopf quer, [1]) Augen höchstens 60 μ lang; Kopfborsten sehr gut entwickelt; vordere Stirnborste 40 μ lang; vor dem vorderen Ocellus eine etwa 20 μ lange Anteocellar-Borste, seitlich des 1. Ocellus eine etwa 28 μ lange Borste; Interocellarborsten lang, etwa 40 μ, zwischen den hinteren Ocellen gelegen, ihr Abstand etwa 12 μ; Postocularborsten gut entwickelt, die beiden inneren Paare etwa 20 μ lang, ein weiteres, hinter den Augen, sehr gut entwickelt, 36 - 40 μ; Mundkegel kurz, Maxillarpalpen kurz, Gl. 1 etwa 11 μ lang, 6 - 7 μ breit, Gl. 2: 17 μ lang; Fühler mässig lang, 260 - 268 μ; Gliederlängen (-breiten): 17 - 20 (B. 25), 34 (24), 43 - 45 (19), 48 (17), 34 (15), 47 - 49 (15), 10 - 11 (6), 14 (3 - 4) μ; Fühlerborsten getrübt; 3. und 4. Glied am Ende geschnürt, 4. länger ausgezogen, Sinneskegelbasis von der Gliedspitze 17 - 18 μ entfernt; Sinneskegel des 4. Gliedes 28 - 31 μ lang; das 4. und 5. Glied mit deutlich abgesetztem Subbasalring, das 5. Glied gegen das Enddrittel erweitert, dann wieder deutlich verengt; 6. Glied mit drei Sinneskegeln, 1 kleinen, etwas gebogenen, der aussen im letzten Drittel entspringt, 8 μ lang ist; die beiden anderen entspringen vor der Mitte des Gliedes, einer innen, einer unten; sie sind mit dem Gliede verwachsen (wie bei *Odontothrips,* aber der ganzen Länge nach d ü n n) und heben sich erst vor dem Gliedende ab, sodass man zwei längliche, dünne (etwa 25 μ lange) areolae sieht; an dem einen Sinneskegel erkennt man, dass seine Spitze etwa das erste Drittel des 8. Gliedes erreicht. Prothorax stark quer, seine Länge schätze ich auf 93 - 95 μ; Vorderecken des Pronotums mit kleinen Borsten, von denen die längste 16 - 20 μ misst, die innere Vorderrandborste aber lang, dunkel, 54 - 58 μ lang, die Hinterecken-Borsten 56 - 65 μ lang; innerhalb stehen nur 2 Paar Posteromarginal-Borsten, die äussere, kurze, 20 μ, die innere, lange 35 - 40 μ; Scheibenborsten sehr spärlich. Beine einfach, Tarsen, von der Seite gesehen, zur Spitze etwas verengt. Mediobasal-Borsten des Metascutums etwa 45 μ lang. Flügel 608 - 612 μ lang, am Ende der Schuppe etwa 65 μ breit; Schuppe mit 4 + 1, Costa mit nur 21 - 22, Hauptader 4 + 3 basalen und 2 an der Spitze stehenden Distal-Borsten, Nebenader mit 11 kräftigen Borsten. Abdomen ohne accessorische Sternitborsten; 8. Tergit mit sehr langem, vollständigem Kamm, seine Zähne gut 16 μ lang; Borsten am 9. Segment, dorsale 44 μ, Hinterrandborsten B. 1: 52 - 56, B. 2: viel kräftiger, 76, B. 3: 64 - 68 μ; Borsten am 10. Segment, B. 1: 64, B. 2: 68 μ lang; Legebohrer 212 - 224 μ lang. Hintertibien innen, ausser den Endsporen, mit nur 3 - 4 Börstchen.

♂ unbekannt.

Fundort: J a v a, Tempoeran, Djatiwald, 15.IX.1912, als Inquiline in Blattrollungen von *Salacia oblongifolia* BL. (Fam. *Hippocrataceae*), erzeugt durch *Smerinthothrips claripennis* (KARNY) (leg. W. DOCTERS VAN LEEUWEN).

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[1]) Die Tiere sind im Präparat gepresst, daher können die Masze des Chitinpanzers nicht angegeben werden, wohl aber sind die Borsten und Körperanhänge ausgezeichnet erhalten.

Bei oberflächlicher Betrachtung erinnert die Art wohl etwas an die *Taeniothrips*-Arten der *salicis*-Gruppe, etwa *propinquus* BAGN., ist aber damit nicht näher verwandt. Sie muss auch mit *dealatus* PR. verglichen werden, der vielleicht auf ein Exemplar begründet ist, das (wegen der wohlentwickelten Ocellen) nicht flügellos, sondern dessen Flügel abgefallen sind. Obwohl die Möglichkeit besteht, dass *dealatus* mit *S. salaciae* in e i n e Gattung gehört, ist die erstere Art durch die kurzen äusseren Prothoraxborsten und die v o r den hinteren Ocellen stehenden Interocellarborsten zweifellos spezifisch verschieden; ich habe diese Art (*dealatus*) nicht mehr vor mir.

Uebersichtstabelle der *Taeniothrips*-Arten des behandelten Gebietes.

In der folgenden Uebersichtstabelle sind die Arten vorerst in 5 Gruppen eingeteilt: **A - E.**

Gruppe **A**: 2 Distalborsten (ausnahmsweise 3) der Hauptader, knapp an ihrer Spitze, sind durch einen verhältnismässig k l e i n e n Zwischenraum von den übrigen Borsten getrennt; Basalborsten sehr zahlreich, über die Flügelmitte hinausreichend. (P. 500).

Gruppe **B**: 2 Distalborsten (ausnahmsweise 1) der Hauptader sind durch einen s e h r w e i t e n Zwischenraum von den basalen getrennt; die Basalborsten erreichen n i c h t die Flügelmitte. (P. 513).

Gruppe **C**: 3 Distalborsten (gewöhnlich 1 + 2; ausnahmsweise 4) vorhanden; Basalborstenzahl verschieden. (P. 517).

Gruppe **D**: Hauptader mit 5 oder mehr Distalborsten. (P. 524).

Gruppe **E**: Flügel verkümmert oder fehlend. (P. 525).

G r u p p e A.

2 (ausnahmsweise 3) Distalborsten der Hauptader, knapp an ihrer Spitze, sind durch einen verhältnismässig k l e i n e n Zwischenraum von den übrigen Borsten getrennt; Basalborsten sehr zahlreich, über die Flügelmitte hinausreichend.

1 (24) Vorderflügel hinter der Basis hyalin, dann mit einer sehr breiten graubraunen Binde (die etwa die Mitte einnimmt), am äussersten Ende wieder schmal getrübt, zwischen der Endtrübung und der dunklen Binde hyalin oder kaum getrübt; die Endtrübung schliesst gewöhnlich die 2 Distalborsten ein.

2 (13) ♀♀.

3 (6) Noch die Basalhälfte des 4. Fühlergliedes licht, oder wenigstens das 3. Glied r e i n h e l l g e l b. Vorderschenkel g a n z dunkel.

4 (5) Das 3. Fühlerglied, das 4. mit Ausnahme eines dunklen Ringes hinter der Mitte, und die Basis des 5. Gliedes hellgelb. Die Aufhellung des Vorder-

flügels vor der Spitze ganz klar, breit, die Spitze nur ganz schmal getrübt. 13 - 14 Basalborsten der Hauptader. .... **setipennis** (KARNY) [1]
(*varicornis* MOULT.)
(Annot. Zool. Japon., 11.4.1928, p. 326; TAKAHASHI, Iconogr. Ins. Japon., 1932, no. 1895; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 276; TAKAHASHI, Philippine Journ. Sci., 60, 4, 1936, p. 432).

5 (4) Das 3. Fühlerglied, meist auch die Basis des 4. hellgelb, das 5. nur mit hellgrauem Ring. Prothoraxborsten kürzer. Die Aufhellung der Vorderflügel vor der Spitze weniger breit und klar. 16 - 17 Basalborsten der Hauptader.
formosae MOULTON
(Annot. Zool. Japon., 11.4.1928, p. 298, 325, fig. 6; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 276; TAKAHASHI, Philippine Journ. Sci., 60, 4, 1936, p. 433) — Neue Fundorte: S u m a t r a, Prapat, Tobasee, 4.VI.1922, in Blüten von *Canavalia ensiformis* DC. (leg. FULMEK). — J a v a, Buitenzorg, 21.VI.1923, in Blüten von *Canavalia ensiformis* (leg. CAMMERLOHER); ibidem, VI.1922 (SMITH leg.).

6 (3) 4. und 5. Fühlerglied, oft auch das 3. dunkel; ist das letztere licht, dann sind auch die Vorderschenkel am ganzen Innenrande und am Ende gelblich.

7 (12) Vorderschenkel ganz dunkel. Fühler meist einfarbig dunkel. Mittel- und Hintertibien am Ende nicht oder kaum aufgehellt. Hauptader mit ausgedehnterer Borstenreihe, 13 - 19 Basalborsten (selten kontinuierlicher Reihe); Nebenader mit 12 - 18 Borsten. Interocellarborsten meist näher beisammen als bei *nigricornis*, Abstand 14 - 22 μ.

8 (9) Fühler schlanker, das 5. Glied 3.2 - 3.5 mal so lang als breit. Sinneskegel länger, 3. und 4. Fühlerglied deutlicher vasenförmig. Kopf breiter. Larven (vermutlich hierher gehörig) haben 9. und 10. Abdominalsegment nicht dunkelbraun. .... **mucunae** spec. nov.

9 (8) Fühler gedrungener, das 5. Glied 2.5 - 2.8 mal so lang als breit. Sinneskegel am 3. und 4. Glied kürzer, das 3. und 4. Glied am Ende nur kurz geschnürt. Larven (des *morosus*) haben das 9. und 10. Segment dunkelbraun chitinisiert, und einige Reihen Micro-Höckerchen am Hinterrande des 8. Sternites.

10 (11) Flügel durchschnittlich länger, 0.95 - 1.14 mm lang; anteapikale Aufhellung der Vorderflügel weniger deutlich, Costa des Vorderrandes dort deutlich getrübt, in der Aufhellung stehen nur 2 - 3 Nebenaderborsten; Nebenader mit 17 - 20 (seltener 15 - 16) Borsten; ausser den Endsporen sind am In-

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[1]) Die Type von *Megalurothrips setipennis* KARNY (Deli Proefstat. Bull. No. 23, 1925, p. 32, fig. 11) ist identisch mit *Taeniothrips varicornis* MOULTON (Trans. Nat. Hist. Soc. Formosa, 18, 1928, p. 292); es ist ein total geschrumpftes, fühlerloses Stück, doch die Flügelfärbung, die Anordnung der Borsten auf denselben und die Masze lassen keinen Zweifel, dass es sich um die obige, mir wohl bekannte Art handelt. Neue Fundorte des *Taen. setipennis* (KARNY) sind folgende: S u m a t r a, Prapat-Tobasee, 4.VI.1922, in Blüten von *Tephrosia candida* (leg. L. FULMEK). — J a v a, Semarang, 25. VIII. 12, in Blüten von *Mangifera indica* (leg. W. DOCTERS VAN LEEUWEN). — K r a k a t a u, am Strande, in Blüten von *Desmodium umbellatum*, 22. I. 1922 (leg. W. DOCTERS VAN LEEUWEN).

nenrande der Hintertibien 7 - 9 (dichter stehende) Dornbörstchen vorhanden. Kopfbreite 190 - 200 μ. .... **distalis** Karny
(= *brunneicornis* Bagn.)

11 (10) Flügel durchschnittlich kürzer, 0.79 - 0.98 (seltener 1) mm lang; anteapicale Aufhellung der Vorderflügel breiter und heller (wie bei *mucunae*), Costa des Vorderrandes an der Aufhellung nicht oder kaum getrübt, 3 - 4 oder mehr Nebenaderborsten in der Aufhellung; Flügelborsten weniger zahlreich, Nebenader mit 13 - 16 (selten 17) Borsten; Innenrand der Hintertibien (ausser den Endsporen) mit 5 - 6 (selten 7) Dornbörstchen. Kopfbreite 172 - 185 μ. .... **morosus** spec. nov.

12 (7) Vorderschenkel am Innenrande und an der Spitze licht, oft verwaschen hellgelb. Fühlerglied 3 immer deutlich lichter als 4. Flügelaufhellung vor der Spitze verhältnismässig breit, hyalin; Mittel- und Hintertibien am äussersten Ende, bisweilen auch an der Basis schmal hellgelb. Hauptader mit 12 - 14, Nebenader mit 12 - 15 Basalborsten. Interocellarborsten meist in normaler Lage, voneinander 18 - 28 μ abstehend. **nigricornis** (Schmutz)
(= *obscuricornis* Schmutz, *longistylus* Karny, *usitatus* Bagnall)

13 (2) Männchen (Sternite in allen Fällen ohne Drüsenfelder).

14 (15) Das 3. Fühlerglied ganz, das 4. und 5. etwa in der Basalhälfte rein hellgelb. .... **? setipennis** (Karny)

15 (14) Fühler dunkler, das 5. Glied nur ganz am Grunde licht oder ganz getrübt, nicht zur Hälfte hellgelb.

16 (19) Auf den Sterniten 2 - 8 zahlreiche accessorische Lanzettbörstchen.

17 (18) Die Hinterrandborsten der Sternite (3 Paare) sind einfach, keine Lanzettborsten; die accessorischen (Lanzettborsten) sind kürzer, abstehend.
peculiaris Bagnall
(= *pingala* Ramakrishna)

18 (17) Auch die Hinterrandborsten der Sternite sind Lanzettborsten, die accessorischen Lanzettborsten länger, kräftiger, dunkler, anliegend.
morosus spec. nov.

19 (16) Sternite ohne accessorische Borsten oder Stacheln.

20 (23) Die Stachelborsten (1 Paar) am Hinterrande des 9. Tergites sind lateral gelegen, an den Hinterecken, also weit voneinander entfernt; in der Mitte des 9. Tergites kein Dornpaar.

21 (22) Prothorax mehr oder weniger hell gelb oder hell orange, Kopf und Abdomenspitze (oder das ganze Abdomen) braun. Fühler mehr weniger graubraun, 3. Glied lichter, doch nicht rein hellgelb. Vorderschenkel gelb, aussen mehr weniger getrübt. Das dorsale Seiten-Dörnchen des 9. Tergites schwach, borstenartig. .... **nigricornis** (Schmutz)

22 (21) Prothorax dunkel wie der übrige Körper. Fühler länger, das 3. Glied hellgelb, das 4. und 5. am Grunde aufgehellt. Vorderschenkel dunkel.
formosae Moulton

23 (20) Am 9. Tergit steht ein Paar dicker Borsten (Stacheln) nahe beieinander, median gelegen, ein schwächeres Paar seitlich. **centrispinosus** spec. nov.

24 (1) Vorderflügel gleichmässig getrübt oder nur an der Basis breit hyalin, vor der Spitze nicht breit hyalin oder stark aufgehellt, seltener gegen die Spitze allmählich aufgehellt.

25 (26) Hintereckenborsten des Pronotums sehr kurz, nicht länger als die übrigen kleinen Hinterrandborsten. Flügel an der Basis breit hell, Borsten schwach. Fühler dunkel. Basalborsten der Hauptader bis zur Flügelmitte reichend. cf. **Anaphothrips corbetti** PR. (Proc. R. Ent. Soc. London, ser. B., vol. 5, 11, 1936, p. 209).

26 (25) Hintereckenborsten des Pronotums (2 Paare) lang.

27 (30) Vorderflügel vor der Spitze mit g a n z l e i c h t e r Aufhellung.

28 (29) 3. Fühlerglied hellgelb, 4. und 5. am Grunde gelblich. cf. **formosae** MLT.

29 (28) Fühler ganz dunkel. .... cf. **distalis** KA.

30 (27) Vorderflügel vor der Spitze nicht aufgehellt.

31 (32) Sehr grosse Art; Kopfbreite 196 μ.; Borsten am 9. Segment über 180 μ.; 8 - 9 dunkle Dörnchen am Innenrande der Hinterschienen; 16 - 19 Basalborsten der Hauptader. .... **distalis** var. **infernalis** nov.

32 (31) Viel kleinere Arten. Borsten am 9. Segment viel kürzer.

33 (34) Kopf lang, im Verhältnis zum Prothorax gross, Schläfen länger als die Augen. 5. Fühlerglied parallelseitig, von der Mitte zum Ende nicht verengt. Beine lichter, nur die Schenkel etwas getrübt. **jonnaphilus** RAMAKRISHNA [1]) (Mem. Dept. Agric. India, Ent. Ser. vol. X, No. VII, 1928, p. 256; STEINWEDEN, Trans. Ent. Soc. Amer., LIX, 1933, p. 280).

34 (33) Kopf stärker quer, Wangen viel kürzer; Schenkel und oft der Grossteil der Tibien dunkel.

35 (36) 3. Fühlerglied 53, 4. Glied 80 μ. lang, das letztere lang flaschenförmig ausgezogen. Sinneskegel sehr lang, spitz, am 4. Fühlerglied 72 μ., aus der Mitte des Gliedes entspringend. Tibien licht, gelblich; Interocellarborsten 45 μ. lang. .... **antennalis** KARNY (Zeit. wiss. Ins. Biol., 1914, p. 356, 1916, p. 32; STEINWEDEN, Trans. Ent. Soc. Amer., 1933, p. 275).

36 (35) 4. Glied kürzer, weniger als 1.4 - 1.5 mal so lang als das 3. (samt Stielchen); Sinneskegel kürzer. Enddrittel der Tibien hellgelb.

37 (38) Grösser; accessorische Borsten vorhanden; Borsten an den Hinterecken des Pronotums 108 - 120 μ. lang; Stylus kurz, 6. Glied lang, Gesamtfühlerlänge 372 - 380 μ. Hauptader mit 4 + 9 basalen und 1 + 1 + 1 distalen Borsten. .... **fulmeki** spec. nov.

38 (37) Kleiner; accessorische Borsten fehlen; Hintereckenborsten viel kürzer. 6. Fühlerglied verhältnismässig kurz (48 - 52 μ.), Stylus lang und schlank; Fühler etwa 285 μ. lang.

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[1]) Diese Art kommt dem *Sorghothrips longistylus* (TRYB.) äusserst nahe, ist aber durch den 2-gliedrigen Stylus verschieden. Wir müssen die Entdeckung des Männchens abwarten, um *T. jonnaphilus* definitiv zuteilen zu können. Es ist mit der Möglichkeit zu rechnen, dass auch das ♂ von *jonnaphilus* nach dem *Sorghothrips*-Typus gebaut ist.

39 (40) 3. Fühlerglied 39 - 44, 4. Glied 48 - 53 µ lang. Flügel an der Basis ein wenig aufgehellt. .... **minor** BAGNALL (Ann. Mag. Nat. Hist. (9), VIII, p. 393, 1921; RAMAKRISHNA, Journ. Bombay N. Hist. Soc., Sep. p. 6, 1925; KARNY, Mem. Dept. Agr. Ind., Ent. Ser. IX, 6, 1926, p. 196, pl. XVII, fig. 5; RAMAKRISHNA, Mem. Dept. Agr. Ind., Ent. Ser. X, 7, 1928, p. 258; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 274).

Neuer Fundort: Sumatra, Medan, V.1922, in Blüten von *Impatiens balsamina* (leg. L. FULMEK) = *balsaminae* PRIES. i. litt. (RAMAKRISHNA AYYAR, Ind. Forest Rec. 1934, XX, p. 4).

40 (39) 3. Fühlerglied 48 - 49, 4. Glied 64 - 66 µ lang. Flügel ganz dunkel. **thunbergiae** KARNY (Treubia, III, 3 - 4, 1923, p. 302, fig. 56a; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 274). — Ist von *minor* vielleicht nicht spezifisch verschieden, doch ist das vorliegende Material zur Klärung dieser Frage ungenügend.

Gruppe B.

2 Distalborsten (aushnahmsweise 1) durch einen sehr grossen Zwischenraum von den basalen getrennt; diese erreichen nicht die Flügelmitte.

1 (4) Einfarbig hellgelbe Arten, bei denen die Flügel licht sind. Sternite ohne accessorische Borsten.

2 (3) 4. und 5. Fühlerglied wenigstens in der Grundhälfte licht, auch das 6. noch am Grunde aufgehellt; 5. Glied von der Mitte zum Ende verengt. **traegardhi** (TRYBOM) (= *niloticus* PRIES.) [1] (Res. Swed. Exped. Egypt, IV, 4, 1911, p. 4 fig. 2, 3; PRIESNER, Bull. Soc. Ent. d'Egypte, 1930, p. 11, fig. 7; 1932, p. 141; KARNY, Zool. Annal., 1912, p. 339; Ent. Zeit. Frankfurt, 1913, No. 5, Anhg.; Zeit. Wiss. Ins.-Biol., 1914, p. 367; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 273, 277).

3 (2) 4. bis 6. Fühlerglied dunkel; Glied 5 am Ende breit abgestutzt (cf. *salicis* REUT.); zwei Paar innere Posteromarginal-Borsten des Prothorax. **glycines** (OKAMOTO) (Wiener Ent. Zeitg. 1911, p. 221) Neuer Fundort: Tokyo, 30.8.1928, an Blättern von *Morus* (leg. M. KUROSAWA).

4 (1) Wenigstens der Kopf getrübt, oder die Flügel dunkel oder mit Binden.

5 (6) Hintereckenborsten des Prothorax (nur 1 Paar vorhanden) lang, stark gebogen und zum Ende verdickt, keulenförmig. Flügel säbelförmig. Prothorax mit dichten, konfluierenden (seitlich betrachtet scharf erhabenen) Querrunzeln. Fühler sehr schlank. cf. **Pteridothrips pteridicola** (KARNY)

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[1]) Die TRYBOMschen typen sind mit meinem *T. niloticus* völlig identisch; es ist daher TRYBOMS Angabe, dass die „Körperfarbe gelbgrau" sei und sich der Hinterleib bei einigen Weibchen trübe, unrichtig und darauf zurückzuführen, dass er sie im durchfallenden Lichte untersuchte. Neuer Fundort dieser aus Afrika bekannten Art: India, Guntur, 7. VII. 1937, aus *Acacia*-Blüten (leg. V. J. RAO).

6 (5) Hintereckenborsten des Prothorax wie gewöhnlich, spitzig, nicht keulenformig.

7 (8) Nebenader des Vorderflügels mit nur wenigen (etwa 5) Borsten; 3.-5. Fühlerglied ganz hell weisslichgelb. Kopf gross. 8. Tergit mit vollständigem Kamm. Männchen mit Dornen am 9. Tergit. ***cardamomi** RAMAKRISHNA [1]) (Bull. Ent. Res. 26, pt. 3, p. 357. - 1935).

8 (7) Nebenader der Vorderflügel mit viel mehr Borsten.

9 (12) Abdominal-Sternite mit zahlreichen accessorischen Borsten.

10 (11) Lichte Art mit sehr dunklen Borsten und dunklen, schmalen Flügeln. **chaetogaster** RAMAKRISHNA (Rec. Ind. Mus. XXXVI, pt. IV, p. 494. - 1934).

11 (10) Abdomen dunkel, Kopf und Thorax lichter, orange. Flügel mit zwei dunklen Binden, die Basis breit hyalin, eine Mittelbinde und die Spitze hyalin. Seiten der Tergite mit Microsetulae besetzt. **setiventris** BAGNALL (Bull. Ent. Res., p. 61, fig., 1918; RAMAKRISHNA AYYAR, Journ. Bombay Nat. Hist. Soc., Sep. p. 6, 1925; KARNY, Treubia III, p. 304/5, fig. 56e. 1923; BLUNCK, in SORAUER, Handb. f. Pflanzenkrankh., IV, p. 262. - 1925; RAMAKRISHNA AYYAR, Mem. Dept. Agr. India, vol. X, No. 7, 1928, p. 261; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 278).

12 (9) Sternite ohne accessorische Borsten.

13 (16) Vorderflügel gebändert, abwechselnd licht und dunkel.

14 (15) Vorderflügel an der Basis samt Schuppe getrübt, dann folgt eine schmale, hyaline Querbinde, weiterhin eine ausgedehnte Trübung, die Flügelspitze selbst ist wieder licht; Abdomen gelblich, 4. und 5. Tergit braun, Seiten des Thorax und Ränder des Kopfes mit Trübungen; 3. und 4. Fühlerglied lang-vasenförmig. .... **taeniatus** KARNY (Treubia, III, 1923, p. 300; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 273).

15 (14) Wie bei vorigem die Basis der Vorderflügel dunkel und die Spitze licht, aber die Mitteltrübung durch eine weitere helle Binde in zwei geteilt, daher drei lichte Binden vorhanden. Abdomen ohne auffallende dunkle Querbinde. Fühler wie bei vorigem. .... **trifasciatus** PRIESNER (Treubia, XV, 3, p. 323 - 1936).

7 (4) Kopfseiten ohne deutliche Kerbzähnchen. Nur 1 Paar Postocellarbörstchen. (Körperfarbe rein hellgelb bis hellorange, bisweilen mit Trübungen).

8 (9) Fühler ganz dunkel, gelbgrau bis graubraun. Körper hellgelb, Abdomen oben mit Trübungen, die in der Mitte das ganze Segment einnehmen. Flügel ganz dunkel, ebenso die Körperborsten, Flügel sehr schmal, Borsten kräftig, Nebenader mit 4 Borsten. Prothoraxhinterrand innen nur mit 2 Paar Börstchen. .... **spec.** [2])

9 (8) Fühler nicht ganz dunkel.

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[1]) Mit einem * versehene Arten waren mir nur nach der Beschreibung bekannt.

[2]) Hieher eine noch unbeschriebene Art, die sich in der Sammlung RAMAKRISHNA AYYAR's befindet (No. 62a, 328a).

10 (11) Fühler schlanker und länger, das 4. Glied mindestens 62 μ lang; 6. Glied ganz dunkel, das 3. und 4. Glied nur am Grunde licht. Interocellarborsten hinter dem vorderen Ocellus gelegen. Hintereckenborsten des Pronotums 72 - 84 μ lang, B. 2 am 9. Segment etwa 120 μ. ...... **sulfuratus** PRIESNER [1])
(Philipp. Journ. Sci., 57, 3, 1935, p. 358; TAKAHASHI, Philipp. Journ. Sci., 60, 4, 1936, p. 434; 'Tenthredo', I, 3, p. 349).

11 (10) Fühler gedrungener, das 4. Glied höchstens 60 μ lang; 6. Glied meist am Grunde aufgehellt, das 3. entweder ganz licht, oder höchstens bis zur Hälfte getrübt, 4. Glied wenigstens im ganzen Grunddrittel licht.

12 (13) Hintereckenborsten des Pronotums verhältnismässig kurz, etwa 55 μ. cf. **Thrips flavidus** BAGN.
(Exemplare mit 2-gliedrigem Stylus).

13 (12) Hintereckenborsten länger.

14 (15) 3. Glied kaum getrübt. Hintereckenborsten des Pronotums 80 - 92 μ lang; B. 1 am 9. Segment 96 - 100 μ, B. 3: 115 - 120 μ. Interocellar-Borsten in oder etwas ausserhalb der Tangente. .... cf. **Thrips flavus** SCHRANK
(monstr. = *Taen. luteus* OETTINGEN, Konowia, XIV, 2, 1935, p. 183, fig.).

15 (14) 3. Glied deutlich getrübt, bisweilen die ganze Distalhälfte; Hintereckenborsten des Pronotums 60 - 70 μ lang; B. 1 am 9. Segment 72 - 88 μ: Interocellar-Borsten hinter dem 1. Ocellus. .... **flavidulus** BAGNALL
(Ann. Mag. Nat. Hist. (9), XII, 1923, p. 628; RAMAKRISHNA AYYAR, Journ. Bombay Nat. Hist. Soc. 1925, Spe. p. 6; MOULTON, Records Ind. Mus. XXXI, II, 1929, p. 95; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 282).

16 (13) Vorderflügel nicht abwechselnd licht und dunkel, höchstens an der Basis licht, oder knapp hinter derselben.

17 (18) Grosse Art mit stark vorgequollenen Augen (Kopfbreite 165 μ oder mehr) und sehr langen Flügelborsten, die Costalborsten 180 - 220 μ lang; Flügellänge mindestens 1.12 mm; Flügel hinter der Basis etwas aufgehellt; 3. Fühlerglied nicht vasenförmig. .... cf. **concaviceps** PRIES.

18 (17) Kleiner, Costalborsten viel kürzer.

19 (22) Flügel an der Basis deutlich etwas aufgehellt, aber nicht hyalin. 8. Tergit mit langem, vollständigem Kamm.

20 (21) Das 3. und 4. Fühlerglied vasenförmig (am Ende kurz geschnürt); Hintereckenborsten des Prothorax lang, 100 - 105 μ; Körper — bis auf die Tibien, die nur schwach getrübt und am Ende licht sind — ganz dunkel. **fallax** PRIESNER
(Treubia, XV, 3, 1936, p. 326).

21 (20) Das 3. und 4. Glied der gedrungenen Fühler durchaus nicht vasenförmig.

[1]) Diese Art ist identisch mit einem Exemplar *Taeniothrips clarus* (det. STEINWEDEN, ex coll. MOULTON, No. 3017, Foochow, China, on wild raspberry, II. 1928); es besteht daher die Möglichkeit, dass *sulfuratus* mit *clarus* übereinstimmt, doch muss ich bemerken, dass ich die Typen des *clarus* nicht gesehen, und dass die Beschreibung des *clarus* sich mit meinen *sulfuratus* nicht deckt.

ohne Spur einer Apikalschnürung; Hinterecken-Borsten des Prothorax kurz, 28 - 42 μ; vier Paar Posteromarginalborsten vorhanden [1]. **immsi** BAGNALL (Ann. Mag. Nat. Hist. (9), XVIII, 1926, p. 106; RAMAKRISHNA AYYAR, Mem. Dept. Agric. Ind., X, No. 7, 1928, p. 256; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 278).

22 (19) Flügel gleichmässig getrübt, höchstens mit sehr kleinem, hellem Fleckchen (Areola) vor dem Beginne der Nebenader.

23 (24) Interocellar-Borsten sehr lang, 64 - 80 μ [2]. Körper dunkelbraun; Fühlerlänge 260 - 277 μ. Flügellänge 710 μ. .... **fallax** var. **pavidus** PRIESNER (Treubia, XV, 3, 1936, p. 327).

24 (23) Interocellarborsten viel kürzer, nicht mehr als 46 μ lang.

25 (26) Die innere Vorderrandborste des Pronotums sehr lang (im Verhältnis zu den Diskalborsten; 6. Fühlerglied mässig lang (49: 15), mit zwei langen Sinneskegeln, die eine Strecke weit mit dem Gliede verwachsen sind, sodass eine dünne Sinnes-Area entsteht. Auffallende Postocularborsten vorhanden. cf. **Smeringothrips salaciae** gen. n., spec. n.

26 (25) Die innere Vorderrandborste des Pronotums nicht auffallend lang; 6. Fühlerglied mit langen, dünnen Sinneskegeln, die aus punktförmiger Basis entspringen. Fast gelbe oder ziemlich lichte Arten, mit dünnen, stark getrübten Flügeln und dünnen Fühlern.

27 (30) Hintereckenborsten des Prothorax 60 - 72 μ lang.

28 (29) 4. Fühlerglied über 70 μ lang, gestreckt vasenförmig. Flügellänge 0.97 - 0.99 mm. .... **scindapsi** PRIESNER (Treubia, XV, 3, 1936, p. 324).

29 (28) 4. Fühlerglied etwa 54 μ lang, am Ende etwas geschnürt, aber nicht lang-ausgezogen. .... **crispator** (KARNY) (Zeit. wiss. Ins.-Biol., 1914, p. 369, 1915, p. 35; STEINWEDEN, Trans. Ent. Soc. Amer., LIX, 1933, p. 274).

30 (27) Hintereckenborsten des Prothorax 48 - 56 μ lang.

31 (32) Körper hellgelb, nur der Kopf vorn getrübt. Hintertibienlänge 140 μ. **tenerrimus** PRIESNER (Treubia, XV, 3, 1936, p. 325).

32 (31) Kopf und Prothorax deutlich, Pterothorax schwach, Abdomen etwas stärker graubraun getrübt. Hintertibienlänge 152 - 156 μ. **hospes** (KARNY) (Zeit. wiss. Ins.-Biol., 1914, p. 369, 1915, p. 36; PRIESNER, Treubia, VIII, Suppl., 1926, p. 66; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 274).

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[1] BAGNALL zählt 5 Paare, da er die zwischen den Hintereckenborsten gelegenen Börstchen dazuzählt, die bei meiner Zählung niemals dazugerechnet sind.

[2] Hierher wäre wohl auch **T. araliae* TAKAHASHI (Philippine Journ. Sci., 60, 4, 1936, p. 434, fig. 1; 'Tenthredo', I, 3, 1937, p. 349) einzureihen, dessen Beschreibung ich erst nach Abschluss dieser Tabelle einsehen konnte. Bei dieser Art sind die Interocellarborsten sehr kräftig, aber doch kürzer (56 μ lang) als bei *fallax v. pavidus*; ausserdem ist *araliae* eine schmutzig-gelbe Art mit breiten braunen Querbinden auf den Tergiten 2 - 6.

Gruppe C.

3 Distalborsten (= 1 + 2, ausnahmsweise 4) vorhanden, Basalborstenzahl verschieden.

1 (16) Körperfarbe hellgelb oder hellorange, am Abdomen und an den Kopfseiten können graue Trübungen vorhanden sein, das Abdomen aber niemals einfarbig dunkel (grau oder braun bis schwärzlich).

2 (3) Fühler fast durchwegs licht braungelb, das 1. Glied weisslich. Grosse Art. **clarus** Moulton (Trans. Nat. Hist. Soc. Formosa, 18, 1928, p. 287; Annot. Zool. Japon., 11, 4, 1928, p. 325; Moulton & Steinweden, Proc. Nat. Hist. Soc. Fukien Univ., III, 1930, p. 4; Steinweden, Trans. Amer. Ent. Soc., LIX, 1933, p. 281, Takahashi, Philippine Journ. Sci., 60, 4, 1936, p. 433).

3 (2) Fühler anders gefärbt.

4 (7) Kopf (scheinbar) mit zwei Reihen kleiner Postokularborsten, d.h. die inneren zwei Postocellaren hintereinander gelegen. Flügel fleckenartig ungleichmässig getrübt, Distalborste 1 steht in einer Trübung. Kopfseiten gekerbt. Metascutum mit Netzstruktur. Abdomen oben oft mit dunklen Flecken oder ganze Segmente der Breite nach dunkel. Grosse, gelbe Arten. (Subg. **Lefroyothrips** nov.)

a (b) Abdomen mit Trübungen. Borsten an den Hinterecken des Prothorax mindestens 56 μ lang.

5 (6) ♀Fühler kürzer, meist dunkel, das 5. Glied am Grunde (unscharf abgegrenzt) licht, das 3. am Grunde und Ende so, das 4. nur am Grunde; ♂: Drüsenfelder der Sternite klein, rundlich. .... **cuscutae** spec. nov.

6 (5) ♀: Fühler länger, das 5. Glied 68 - 78 μ lang, in der Grundhälfte (oder mehr) hellgelb, 3. wie vorhin, das 4. Glied am Grunde scharf-abgegrenzt hellgelb; ♂: Drüsenfelder stark quer, breit-oval. .... **lefroyi** (Bagnall) (Ann. Mag. Nat. Hist. (8), XII, 1913, p. 292; Bull. Ent. Res., IX, 1, 1918, p. 63, fig. 2; Takahashi, Philippine Journ. Sci., 60, 4, 1936, p. 431. — Alle übrigen Angaben zweifelhaft).

b (a) Körper einfarbig hellgelb bis orange, in beiden Geschlechtern. Borsten an den Prothorax-Hinterecken höchstens 52 μ lang. 3. Fühlerglied ganz licht. Fühler gedrungener als bei *lefroyi*. .... **theiphilus** spec. nov.

16 (1) Dunkle Arten; wenigstens Kopf und Abdomenende dunkel (blasse Stücke hell-braungrau) oder der Körper vorn orange und das ganze Abdomen dunkel.

17 (20) Pronotum mit nur 1 starken, mehr weniger langen Hintereckenborste jederseits, die der inneren entspricht, innerhalb derselben mit 2 Paar Posteromarginal-Borsten. Interocellarborsten mässig lang. Sternite ohne accessorische Borsten; 10. Segment oben nicht gespalten.

18 (19) Klein. Hintereckenborste des Prothorax lang, gebogen, zum Ende lang-

keulig erweitert. Pronotum-Fläche mit sehr feinen erhabenen Riefen. Kopf, Pronotum und Abdominalsegmente stark quer.

cf. **Pteridothrips pteridicola** (KARNY)

19 (18) Grösser. Hintereckenborste zum Ende dünn, zugespitzt. Pronotum ohne erhabene Riefen.

a (b) Körper auffallend zweifarbig (Abdomen in der Mitte gelb); Interocellarborsten lang; Flügel gebändert. .... cf. **Dichromothrips** PRIES.

b (a) Körper einfarbig; Interocellarborsten kürzer; Flügel nicht gebändert.

cf. **Eugeniothrips** HOOD

c (d) Hintereckenborsten des Prothorax etwa 50 μ lang; 3. und 4. Fühlerglied am Ende kurz-flaschenförmig ausgezogen, der Hals nur wenig oder nur am 4. Glied aufgehellt. Hintertibien am Ende etwas lichter.

cf. **Eugeniothrips borneensis** sp. n.

d (c) Hintereckenborsten des Pronotums 76 - 80 μ lang; 3. und 4. Fühlerglied am Ende lang-flaschenförmig ausgezogen, der Hals hellgelb. Hintertibien fast in der ganzen Endhälfte hellgelb.

cf. **Eugeniothrips smithi** (ZIMMERMANN)

(= *Physopus smithi* ZIMM., Bull. Inst. Bot. Buitenzorg, p. 10, 1900; KARNY, Zeit. wiss. Ins.-Biol., 1914, p. 368; Zool. Annal., 1912, p. 340; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 288; TAKAHASHI, Philippine Journ. Sci., 60, 4, 1936, p. 434; PRIESNER, Philippine Journ. Sci., 57, p. 356, 1935 (verbesserte Beschreibung).

20 (17) Pronotum mit 2 Paar Hintereckenborsten.

21 (28) Das 4. Fühlerglied sehr lang flaschenförmig, der Innenrand der Gabeltrichome von der Gliedspitze 28 - 52 μ entfernt.

22 (23) Hauptader mit 6 Basalborsten. Beim ♂ ist das 6. bis 8. Fühlerglied zu einem Ganzen verschmolzen und die Sinneskegel des 3. und 4. Gliedes sind ungewöhnlich lang, die des 4. Gliedes die Fühler etwas überragend.

* **mischocarpi** (ZIMMERMANN)

(Bull. Inst. Bot. Buitenzorg, No. VII, 1900, p. 8, fig. 1; KARNY, Zeit. wiss. Ins.-Biol., 1914, p. 368; KARNY, Zool. Annal., 1912, p. 340; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 288).

23 (22) Hauptader mit 8 - 10 Basalborsten.

24 (25) Das 3. Glied der Fühler 84 - 88, das 4. Glied 104 - 128 μ lang, Abstand des Innenrandes der sehr langen Gabeltrichome von der Gliedspitze mindestens 52 μ; das Trichom des 4. Gliedes erreicht das Ende des 5. Gliedes; Hintereckenborsten des Prothorax etwa 120 μ lang. Schenkel und bisweilen auch die Tibien leicht getrübt. Mitunter sind 4 Distalborsten der Hauptader vorhanden. .... **lagoenifer** spec. nov.

25 (24) Trichome kürzer, die Masze des 3. und 4. Gliedes anders.

26 (27) Das 8. Fühlerglied etwa so lang wie das 7. oder sogar etwas kürzer (14 - 16 μ: 17 - 18 μ); das 4. Glied wenigstens 1.2 mal so lang wie das 3., das 5. Glied 58 μ. Beine ganz hellgelb. .... **cyrtandrae** spec. nov.

27 (26) Das 8. Fühlerglied deutlich länger als das 7., das 4. Glied so lang oder 1.1 mal so lang wie das 3.; Schenkel und Schienen wenigstens z. Teil dunkel.

a (b) Sinneskegel kürzer, am 4. Gliede etwa 45 μ.; 5. Fühlerglied 45 - 48 μ. lang, Flügel 1.02 mm lang. .... cf. **gracilis** MLT.

b (a) Sinneskegel länger, am 4. Gliede 64 - 76 μ.; 5. Fühlerglied 56 μ. lang; Flügel 1.19 - 1.38 mm lang. Fühler schlanker. .... cf. **miorhizae** sp. n.

28 (21) Das 4. Fühlerglied weniger lang, doch bisweilen am Ende geschnürt, wie bei den vorigen; Abstand des Innenrandes des Gabeltrichoms des 4. Gliedes von der Glied-Spitze 20 - 26 μ.

29 (30) Die Basalborsten der Hauptader laufen bis über die Flügelmitte hinaus. cf. Gruppen **A** und **B**

30 (29) Die Basalborsten der Hauptader enden vor oder etwa in der Mitte.

31 (32) Flügel sehr schmal, etwa wie bei *Sericothrips,* und haben nur 4 - 5 Nebenader-Borsten. 8. Tergit oben, lateral, mit einigen Microsetulae, Kamm nur an den Seiten sehr spärlich entwickelt. 10 Segment oben fast bis zur Basis gespalten. .... cf. **Plutonothrips ficicola** (FULMEK)
(= *Pl. cuspidatus* PR. = *Taeniothrips ficicola* FULMEK)

32 (31) Flügel normal.

33 (34) Das 4. und 5. Fühlerglied wenigstens im basalen Drittel r e i n h e l l g e l b.

34 (41) Sternite o h n e accessorische Borsten.

35 (36) Sehr grosse Art, Flügellänge 1.176 - 1.194 mm. Augen stark vorgequollen, Kopfseiten konkav. Borsten an den Prothorax-Hinterecken lang, etwa 140 μ., haarartig und stark gebogen. Die Flügelborsten, besonders der Costa, ungewöhnlich lang, etwa bis 220 μ.. Das 8. Tergit ohne Kamm.
concaviceps spec. nov.

36 (35) Kopf hinter den Augen mehr weniger geschnürt, aber nicht eine Strecke weit konkav. 8. Tergit mit langem Kamm.

37 (40) Kleinere Arten, Flügellänge 605 - 952 μ..

38 (39) Weibchen. Wangen etwas gewölbt, Augen nicht stark vorgequollen; Borsten an den Hinterecken des Pronotums höchstens 112 μ. lang; Aufhellung an der Flügelbasis undeutlich und kaum abgegrenzt. cf. **fallax** sp. n.

39 (38) Männchen. Augen vorgequollen. Flügel gleichmässig bräunlich getrübt. cf. **amomi** und **associatus** n. spp.

40 (37) Grössere Art vom Habitus des *Taen. picipes* (ZETT.); Flügellänge 1.33 mm; Wangen stark gewölbt, Augen stark vorgequollen. Borsten an den Hinterecken des Prothorax mindestens 124 μ. lang. Aufhellung an der Flügelbasis scharf abgegrenzt. .... **oreophilus** PRIESNER
(Philippine Journ. Sci., 57, 3, 1935, p. 355; TAKAHASHI, Philipp. Journ. Sci., 60, 4, 1936, p. 434; 'Tenthredo', I, 3, p. 348).

41 (34) Sternite mit zahlreichen accessorischen Borsten.

42 (43) 8. Tergit in der Mitte ohne Kamm. Hauptader mit 4 - 7, selten nur 3 Distalborsten der Hauptader. 5. Fühlerglied am Grunde kaum aufgehellt. cf. **vitticornis** KARNY

43 (42) Kamm am 8. Tergit wenigstens seitlich entwickelt. Hauptader normal mit 3 Distalborsten. 5. Fühlerglied am Grunde aufgehellt.

44 (45) Kopf und Thorax hellorange, Abdomen dunkel; Scheitel ohne scharf markierte, dunkle Hinterrand-Linie. Männchen hellgelb. Flügel am Grunde aufgehellt. Innere Hintereckenborsten 48 - 60 μ lang.

cf. **Thrips hawaiiensis** f. **imitator** PR.
(= *Taeniothrips albipes* BAGN.)

45 (44) Kopf und Thorax, wenn auch mit orange Pigment, immer deutlich graubraun getrübt, meist fast so dunkel wie das Abdomen. Scheitel-Hinterrandlinie scharf markiert, dunkel.

46 (47) Vorderflügel am Grunde aufgehellt, wenn auch nicht ganz hyalin. Borsten an den Hinterecken des Pronotums 50 - 65 μ lang. Hinterrand des 8. Tergites gerade. (Männchen noch unbekannt). .... **pallipes** BAGNALL
(s. ergänzende Beschreibung unten)

47 (46) Vorderflügel einfarbig stark getrübt. Borsten an den Pronotumecken kürzer, 40 - 48 μ lang; Hinterrand des 8. Tergites in der Mitte flach aber deutlich im Bogen eingebuchtet. Männchen hellgelb. **rhodomyrti** spec. n.

48 (33) Das 5. Glied dunkel, höchstens mit einem schmalen, weisslichen oder blassgelben Ring nahe am Grunde.

49 (72) Kopf mit stark gewölbten, stark vorspringenden Augen, hinter denselben mit starker Schnürung, die Wangen entweder wenig gewölbt — dann der Kopf an den Augen viel breiter als an den Wangen —, oder die Wangen stark gewölbt (cf. *Taen. picipes* ZETT.), oft nach hinten verbreitert.

50 (51) Kleine Art, 3. Fühlerglied 38 μ, 4. Gl. 35 μ lang. Pronotum innen am Hinterrand mit 4 Paar kleinen Börstchen. .... cf. **immsi** BAGNALL

51 (50) Grössere Arten mit geringerer Anzahl innerer Hinterrandborsten des Pronotums.

52 (61) 4. Glied der Fühler deutlich länger als das 3. (samt Stielchen), wenigstens 1.1 mal so lang. Mittelgrosse, meist schlanke Arten.

53 (54) 8. Fühlerglied doppelt so lang als das 7. (18 μ: 9 μ); 4. Fühlerglied am Ende geschnürt .... cf. **gracilis** MOULTON, cf. **rohdeae** KUROSAWA

54 (53) 8. Fühlerglied nicht doppelt so lang als das 7.

55 (60) Die beiden Stylusglieder lang, doch untereinander ungefähr gleich lang; 4. Glied halsartig geschnürt.

56 (57) Auch das 3. Fühlerglied mehr weniger getrübt (Weibchen). Pronotum mit sehr zahlreichen, feinen, konfluierenden Querrunzeln; innerhalb der Eckenborsten stehen 4 Paar Börstchen; 3 - 4 Paar Anteocellarborsten. 4. Fühlerglied flaschenförmig. Mittel- und Hintertibien dunkel, nur an der äussersten Spitze licht. Kopf in einen Fortzatz ausgezogen.

associatus spec. nov.

57 (56) 3. Fühlerglied oft hellgelb. Querrunzeln am Pronotum viel weniger deutlich und weniger dicht; innerhalb der Eckenborsten stehen 2 - 3 Paar Börstchen; nur 1 langes Paar Anteocellarborsten, weit vor dem vorderen Ocellus,

vorhanden. Mittel- und Hintertibien fast ganz licht und die Enden der Schenkel aufgehellt.

58 (59) Kleiner; Borsten an den Prothorax-Hinterecken 60 - 72 μ lang; Innenrand der Hinterschienen (abgesehen v.d. Sporen) oft nur mit 7 Börstchen; Kopflänge 164 - 168 μ; Fühlerlänge etwa 355 μ. .... **amomi** spec. nov.

59 (58) Grösser; Borsten an den Prothorax-Hinterecken 84 - 96 μ lang; Innenrand der Hinterschienen mit 9 Börstchen. Kopflänge 192 - 196 μ; Fühlerlänge 380 - 400 μ. .... **nomoceras** (KARNY)
(= *Mecothrips nomoceras* KA.)

60 (55) Die beiden Stylusglieder in der Länge von einander verschieden; das 4. Glied zum Ende zwar verlängert und verschmälert, aber nicht deutlich halsartig geschnürt. Fühler ganz dunkel, nur die Umgebung der Einlenkungsstelle der Sinnesgabel am 3. und 4. Glied aufgehellt, ebenso die äusserste Basis des 3. Gliedes; Mittel- und Hintertibien stark getrübt. 1 Paar k l e i n e r Anteocellarborsten, seitlich des vorderen Ocellus. **cognaticeps** PR. [1])
(Stylops, IV, 1935, p. 127 TAKAHASHI, Philippine Journ. Sci., 60, 4, 1936, p. 434; Tenthredo, I, No. 3, p. 349).

61 (52) Das 4. Glied nur so lang oder kaum länger als das 3., oder auch etwas kürzer.

62 (65) Das 4. Fühlerglied und die Hintertibien wenigstens am äussersten Grunde hellgelb. 3. Fühlerglied hellgelb.

63 (64) Flügelborsten länger, 1. Distalborste der Hauptader etwa 95 - 100 μ; Maxillarpalpen-Glieder etwa 22, 18 - 20 und 25 μ lang. **alticola** PRIESNER
(Philippine Journ. Sci., 57, 1935, p. 355, 356; Treubia, XV, 3, 1936, p. 327 (Originalbeschreibung)).

64 (63) Flügelborsten kürzer, 1. Distalborste der Hauptader etwa 64 - 70 μ lang; Maxillarpalpen-Glieder nur undeutlich 3-gliedrig (Gl. 2 + 3: etwa 28 μ).
cf. **nomoceras** KA. und **amomi** PR.

65 (62) Das 4. Fühlerglied fast ganz dunkel, höchstens an der Basis mit hellgrauem Ring; 3. Glied dunkel oder wenigstens oben so.

66 (71) Anteocellarborsten in der Höhe des 1. Ocellus oder in der Höhe des Vorderrandes des 1. Ocellus, Interocellarborsten etwa in der Höhe des Vorderrandes der hinteren Ocellen; 4. Fühlerglied etwas oder deutlich länger als das dritte, oder so lang wie dieses.

67 (69) Flügel an der Basis hyalin; Flügellänge des ♀ nicht über 1.04 mm; 3. Fühlerglied ganz dunkel, nur der Endhals licht; Microporen des 1. Tergites dem Hinterrande sehr nahe, von einander weit (32 - 34 μ) entfernt.
gracilis MOULTON
(Trans. Nat. Hist. Soc. Formosa, 18, 1928, p. 289; MOULTON, Annot. Zool. Japon., 11, 4, 1928, p. 326; MOULTON & STEINWEDEN, Proc. Nat. Hist. Soc. Fukien Univ., III, 1930, p. 5; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 272, 283; TAKAHASHI, Philippine Journ. Sci., 60, 4, 1936, p. 433).

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[1]) Vergl. **rohdeae* KUROSAWA (Kontyu, XI, 3, 1937, p. 273, Pl. I, figs. 5, 6, 8).

68 (67) Flügel an der Basis bisweilen etwas heller, aber nicht hyalin; Flügel länger als bei *gracilis*. Microporen des 1. Tergites einander näher, meist vom Hinterrande weiter entfernt als voneinander.

69 (70) Kopf an den gewölbten Wangen so breit oder breiter als an den Augen; Stirn zu beiden Seiten der Mittellinie mit 6 Paar Borsten, von denen das 5. Paar von den inneren Hinterecken der Augen etwa 12 - 15 μ entfernt ist. **montivagus** PRIESNER (Philippine Journ. Sci. 57, 1935, p. 355, 356; Stylops, IV, 1935, p. 129; Beschreibung unten).

70 (69) Kopf an den vorgequollenen Augen etwas breiter als an den nicht oder wenig gewölbten Wangen; Ommatidien grösser; das 5. Stirnborsten-Paar dem hinteren Innenwinkel der Augen viel näher gerückt, nur 4 - 8 μ entfernt. Fühler etwas schlanker, Stylus dünner. .... **miorhizae** PRIESNER (Stylops, IV, 1935, p. 129; Originalbeschreibung unten).

71 (66) Anteocellarborsten wohl entwickelt, deutlich v o r der Höhe des 1. Ocellus; Interocellarborsten zwischen den hinteren Ocellen; 4. Fühlerglied wenig aber merklich kürzer als das 3. (4. Gl. 98 - 100 μ, 3. Gl. 102 - 104 μ). Borsten 3 des 9. Segmentes etwa 200 μ lang. .... **major** BAGNALL (Ann. Mag. Nat. Hist. (8), XVII, 1916, p. 216; RAMAKRISHNA AYYAR, Journn. Bombay Nat. Hist. Soc., 1925, Sep. p. 5; Mem. Dept. Agr. Ind., X, 7, 1928, p. 258; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 272).

72 (49) Kopf mit wenig stark vorspringenden Augen, die Einschnürung hinter denselben normal, nicht besonders auffallend (etwa wie bei *Taen. vulgatissimus* HAL.); Kopf oft kurz und stark quer.

73 (74) Interocellarborsten sehr lang, mindestens 88 μ, dunkel, hinter dem vorderen und fast zwischen den hinteren Ocellen gelegen. Grosse Arten. cf. 60, 69, 70.

74 (73) Interocellarborsten in normaler Lage oder ausserhalb der Tangente gelegen; wenn etwas innerhalb, dann unter 40 μ lang.

75 (76) Sternite ohne accessorische Borsten. .... cf. **immsi** BAGNALL

76 (75) Sternite mit mehr weniger zahlreichen accessorischen Borsten.

77 (80) Hinter den hinteren Ocellen je zwei Börstchen hintereinander, also 1 accessorische Borste ausserhalb der normalen, bogenförmig um die Augen angeordneten Postokular-Reihe.

78 (79) 6. Fühlerglied am Grunde etwas geschnürt (gestielt); Interocellarborsten etwas ausserhalb der Tangente gelegen. Borsten 2 des 9. Segmentes über 140 μ lang. Flügel ziemlich licht. .... **alliorum** PRIESNER (Stylops, IV, 1935, p. 128; TAKAHASHI, Philippine Journ. Sci., 60, 4, 1936, p. 437).

79 (78) 6. Fühlerglied am Grunde breit, fast so breit wie das 5. am Ende; Interocellarborsten etwas innerhalb der Tangente. Borsten 2 des 9. Segmentes unter 120 μ lang. Flügel stark getrübt. .... **longiceps** BAGNALL (Ann. Mag. Nat. Hist. (8), XVII, 1916, p. 220; RAMAKRISHNA AYYAR,

Journ. Bombay Nat. Hist. Soc., 1925, Sep. p. 6; Mem. Dept. Agr. Ind., X, 7, 1928, p. 258; Steinweden, Trans. Amer. Ent. Soc., LIX, 1933, p. 283).

80 (77) Hinter den hinteren Ocellen nur 1 Paar Börstchen, das das Ende der bogenförmigen Postokular-Borstenreihe darstellt, die also nicht verdoppelt ist.

81 (84) Das 3. Fühlerglied so dunkel oder fast so dunkel wie das 4.; Flügel gleichmässig getrübt, an der Basis nicht oder wenig aufgehellt.

82 (83) Kleinere Art, mit lichteren, schwach getrübten Beinen; Flügel 0.9 mm nicht überragend; Nebenader mit 11 - 15 Borsten. ...... **pavettae** spec. nov.

83 (82) Grössere Art, mit dunklen Beinen und Flügeln und sehr langen Borsten; Flügellänge 1.1 - 1.31 mm; Nebenader mit 16 - 18 Borsten. **tristis** spec. nov.

84 (81) Das 3. Fühlerglied deutlich heller als das 4., oft ganz hellgelb; Flügel verschieden, am Grunde aufgehellt oder ganz dunkel.

85 (90) 4. Fühlerglied am Ende deutlich halsartig geschnürt, immer vor dem Ende etwas konkav, aber n i c h t lang ausgezogen flaschenartig, Sinneskegel lang.

86 (89) Kamm am 8. Tergit zart aber vollständig. Flügel ganz dunkel oder hinter der Basis nur wenig aufgehellt. Nebenader mit 11 - 14, selten 15 Borsten.

87 (88) Fühler länger, Glieder 3 - 6: 73 - 76, 71 - 76, 47 - 50, 67 - 70 μ; das 3. Glied viel lichter als die folgenden, gelblich, oben und gegen das Ende getrübt; Prothoraxborsten länger, die äusseren Hinterecken-Borsten 95 - 102 μ lang; Costalborsten länger, 4. 60 - 72 μ lang. Vorn und unten keine auffallenden Augenfacetten. .... **brevistylus** spec. nov. [1])

88 (87) Fühler kürzer, fast ganz dunkel, Glieder 3 - 6: 64 - 66, 64 - 66, 42, 70 - 76 μ; Costalborsten kürzer, B. 4 etwa 44 - 55 μ lang; einige Augenfacetten — vorn und unten — auffallend gross, 25 μ im Durchmesser.
cf. **pavettae** sp. n.

89 (86) Kamm des 8. Tergites in der Mitte unterbrochen, an den Seiten deutlich; Flügel an der Basis deutlich aufgehellt. Nebenader mit 15 - 16 Borsten.
leeuweni spec. nov.

90 (85) 4. Fühlerglied vor dem Ende etwas verengt, dort aber nicht oder kaum konkav, nicht vasenförmig.

91 (94) Wenigstens auf e i n e m der Vorderflügel 4 - 5 oder mehr Distalborsten vorhanden.

92 (93) Kamm des 8. Tergites in der Mitte unterbrochen. cf. **vitticornis** Ka.

93 (92) Kamm des 8. Tergites vollständig.

94 (91) Flügel mit 3 Distalborsten.

95 (96) Kamm des 8. Tergites in der Mitte gar nicht, an den Seiten schwach entwickelt. Flügel ganz dunkel. Borsten an den Hinterecken des Pronotums 64 - 70 μ lang; Mittel- und Hintertibien nur an der Spitze gelblich; Körper im Thorax mit rötlichem Pigment; accessorische Borsten der Sternite mässig dicht. .... **kotoshoi** Moulton

[1]) *T. andrewsi* Bgn. ist von *corymbicola* durch längere dünnere Fühler und die an der Basis hyalinen Flügel leicht zu unterscheiden.

(Annot. Zool. Japon., 11, 4, 1929, p. 300, 326; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 284); TAKAHASHI, Philippine Journ. Sci., 60, 4, 1936, p. 433).

96 (95) Kamm des 8. Tergites vollständig, wenn auch meist nicht sehr lang. Flügel an der Basis etwas aufgehellt oder hier ganz hyalin; wenn sie gleichmässig getrübt sind, dann sind die Prothoraxborsten kurz.

97 (98) Flügel gleichmässig getrübt. Kleine Art mit kurzen (0.58 - 0.64 mm) Flügeln. Hinterrand des 8. Tergites im Bogen flach eingebuchtet.
rhodomyrti spec. nov.

98 (97) Flügel an der Basis deutlich aufgehellt oder hier fast hyalin.

99 (100) Grosse Art mit langen, schlanken Fühlern, deren 4. Glied etwa 76, 6. Gl. 65 μ misst; Hintereckenborsten des Pronotums wenigstens 88 μ lang, Flügellänge 0.98 - 1.04 mm, innerste Postocellarborste in Länge und Färbung von den anderen wenig verschieden; Kamm am 8. Tergit aus Zähnchen bestehend, die in der Mitte in Gruppen zu drei angeordnet sind; Microporen des 1. Tergites vom Hinterrande weiter (12 μ) abstehend als bei den folgenden Arten. .... **andrewsi** BAGNALL
(Ann. Mag. Nat. Hist. (9), VIII, 1921, p. 394; RAMAKRISHNA AYYAR, Journ. Bombay Nat. Hist. Soc., 1925, p. 6; Mem. Dept. Agr. Ind., X, 7, 1928, p. 256; MOULTON & STEINWEDEN, Proc. Nat. Hist. Soc. Fukien Univ., III, 1930, p. 4; STE..NWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 282).

100 (99) Kleinere Arten. Poren des 1. Tergites 8 μ vom Hinterrande entfernt. Auch sonst anders.

101 (102) 4. Fühlerglied 60 - 65 μ lang; Flügel 0.89 - 0.92 mm lang; Prothoraxborsten der Hinterecken 64 - 68 μ, an den Vorderecken 28 μ.
eriobotryae MOULTON
(Annot. Zool. Japon., 11, 4, 1929, p. 297, fig. 5, p. 325; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 286).

102 (101) Fühler, Borsten und Flügel kürzer. .... **pallipes** f. **florinatus** nov.

Gruppe D.

5 oder mehr Distalborsten der Hauptader. Sternite mit accessorischen Borsten.

1 (2) 8. Tergit am Hinterrande in der Mitte ohne Kamm. Innenseite der Hinterschienen mit 13 - 14 Dörnchen ausser den beiden Endsporen. Flügel an an der Basis kaum aufgehellt. Fühler schlank. .... **vitticornis** KARNY
(Journ. Siam Soc., XVI, 2, 1923, p. 103; Treubia, III, 1, 1922, p. 110; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 292; **canavaliae** MOULTON, Annot. Zool. Japon., 11, 4, 1929, p. 295, fig. 4, p. 325; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 289; TAKAHASHI, Philippine Journ. Sci., 60, 4, 1936, p. 433). — Fundorte: Java, Semarang, am Strande, 25.V.1914, in Blüten von *Canavalia lineata* DC.; Buitenzorg, 13.VIII.1920, in Blüten von *Tithonia diversifolia* A. GR. (W. & H. DOCTERS

VAN LEEUWEN); Buitenzorg, 26.VI.1923, in Blüten von *Canavalia ensiformis* D.C. (leg. CAMMERLOHER). — Verlaten Eiland, 26.IV.1921, in Blüten von *Canavalia lineata* (leg. W. DOCTERS VAN LEEUWEN). — Krakatau, am Strande, 19.I.1922, in Blüten von *Canavalia lineata,* und 23.I.1922, in Blüten von *Derris uliginosa* LOUR. (leg. W. DOCTERS VAN LEEUWEN). — Sumatra, Prapat, Toba-See, 4.VI.1922, in Blüten von *Canavalia ensiformis* (leg. L. FULMEK).

2 (1) 8. Tergit mit vollständigem Kamm, der aus mässig langen Härchen besteht. Innenseite der Hinterschienen mit weniger Dörnchen. Eine deutliche Lücke zwischen Basal- und ersten Distalborsten der Hauptader. **simplex** MORISON (Bull. Ent. Research, XXI, 1930, p. 12; KELLY & MEYNE, Austral. Thrips, 1934, p. 26; MOULTON & ANDRE, Iowa Coll. Journ. Sci., X, 1936, p. 229; BAILEY, Ent. News, XLVIII, 1937, p. 47; **gladioli** MOULTON & STEINWEDEN, Canad. Entom., LXIII, 1931, p. 20, fig. 1; STEINWEDEN, Trans. Amer. Ent. Soc., LIX, 1933, p. 289; HERR, Bull. Ohio Agr. Experim. Sta., No. 537, 1934, 64 pp. figs.; NEWMAN, Journ. Soc. West. Austral., XXI, 1935, p. 95; MOULTON, Ann. Mag. Nat. Hist. (10), XVII, 1936, p. 507; BAILEY, Ent. News, XLVIII, 1937, p. 47.

Gruppe E.

Flügel verkümmert oder fehlend [1]). .... **dealatus** PRIES. (Zool. Jahrb., Syst., 56, 1928, p. 43, Fig. 1).

Namenliste.

Albipes BAGN. = *Thrips hawaiiensis* f. *imitator* PR.
alliorum PR.
alticola PR.
amomi PR.
andrewsi BAGN.
antennalis KA.
araliae TAK.
associatus PR.
balsaminae PR. i. litt. = *minor* BAGN.
borneensis PR. = *Eugeniothrips borneensis* PR.
brevistylus PR.
brunneicornis BAGN. = *distalis* KA.
canavaliae MOULT. = *vitticornis* KA.
cardamomi RAM.
centrispinosus PR.
chaetogaster RAM.
clarus MOULT.
cognaticeps PR.
concaviceps PR.
crispator KA.
cuscutae PR.
cyrtandrae PR. und var. *amphorifer* PR.
dealatus PR.
eriobotryae MOULT.
fallax PR. und var. *pavidus* PR.
ficicola FULM. = *Plutonothrips ficicola* (FULM.)
flavidulus BAGN.
flavidus BAGN. = *Thrips flavidus* BAGN.
formosae MOULT.
fulmeki PR.
gladioli MOULT. & STEINW. = *simplex* MORIS.
glyzines OKAM.

[1]) Arten mit verkümmerten Flügeln sind aus der Orientalischen Region noch nicht bekannt, wiewohl sie vorkommen müssen. *T. dealatus* ist wahrscheinlich auf ein Exemplar begründet, dessen Flugel abfielen; die Art (*dealatus*) macht den Eindruck als zur Gruppe B gehörig oder zu *Smeringothrips.*

gracilis MOULT.
hawaiiensis MORG. = *Thrips hawaiiensis* f. *imitator* PR.
hospes KA.
immsi BAGN.
infernalis PR. = *distalis* var. *infernalis* PR.
jonnaphilus RAM.
karafutensis ISH. ist kein *Taeniothrips*, vielleicht ein *Sericothrips*.
konumensis ISH. ist ein *Odontothrips*.
kotoshoi MOULT.
lagoenifer PR.
leeuweni PR.
lefroyi BAGN.
longiceps BAGN.
longistylus KA. = *nigricornis* SCHM.
luteus V. OETT. = *Thrips flavus* f. *lutea* OETT. (Juni 1935) (*biarticulata* PR. 1935).
major BAGN.
minor BAGN.
miorhizae PR.
mischocarpi ZIMM.
montivagus PR.
morosus PR.
mucunae PR.
nigricornis SCHM.
niloticus PR. = *traegardhi* TRYB.
nomoceras (KA.)
obscuricornis (SCHM.) = *nigricornis* (SCHM.)
oreophilus PR.
pallipes BAGN. und var. *florinatus* PR.
pavettae PR.
peculiaris BAGN.
pingala RAM. = *peculiaris* BAGN.
pteridicola KA. = *Pteridothrips pteridicola* (KA.)
rhodomyrti PR.
rohdeae KUROS.
scindapsi PR.
serratus KA. (nec KOBUS) = *Bregmatothrips* sp.
setipennis (KA.)
setiventris BAGN.
sexnotatus (ZEHNT.) = *Physopus sexnotatus* Z., wahrscheinlich kein *Taeniothrips*, mir unbekannt.
smithi (ZIMM.) = *Eugeniothrips smithi* (ZIMM.)
sulfuratus PR.
taeniatus KA.
tenerrimus PR.
theiphilus PR.
thunbergiae KA.
traegardhi (TRYB.)
trifasciatus PR.
tristis PR.
ulmifoliorum KA. (nec UZEL) = *Smeringothrips salaciae* PR.
usitatus BAGN. = *nigricornis* (SCHM.)
varicornis MOULT. = *setipennis* (KARNY)
vitatus (SCHM.) = fraglich
vitticornis KA.

Weder in den Beschreibungen noch in der Tabelle berücksichtigt wurden die folgenden Arten:

1. *T. karafutensis* und *T. konumensis* ISHIDA, welche sicher nicht in die Gattung *Taeniothrips* gehören.
2. *Physopus sexnotatus* ZEHNTNER, da diese Art noch nicht wiedergefunden wurde, und nach der Beschreibung nicht deutbar ist.
3. *Frankliniella vitata* SCHMUTZ, zwar wahrscheinlich zu *Taeniothrips* gehörig, mir aber nicht bekannt geworden.

Abgeschlossen am 3.I.1938.

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